IMPACT OF NEW SUPPORT TECHNOLOGIES

INPUT

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Impact of New Support Technologies

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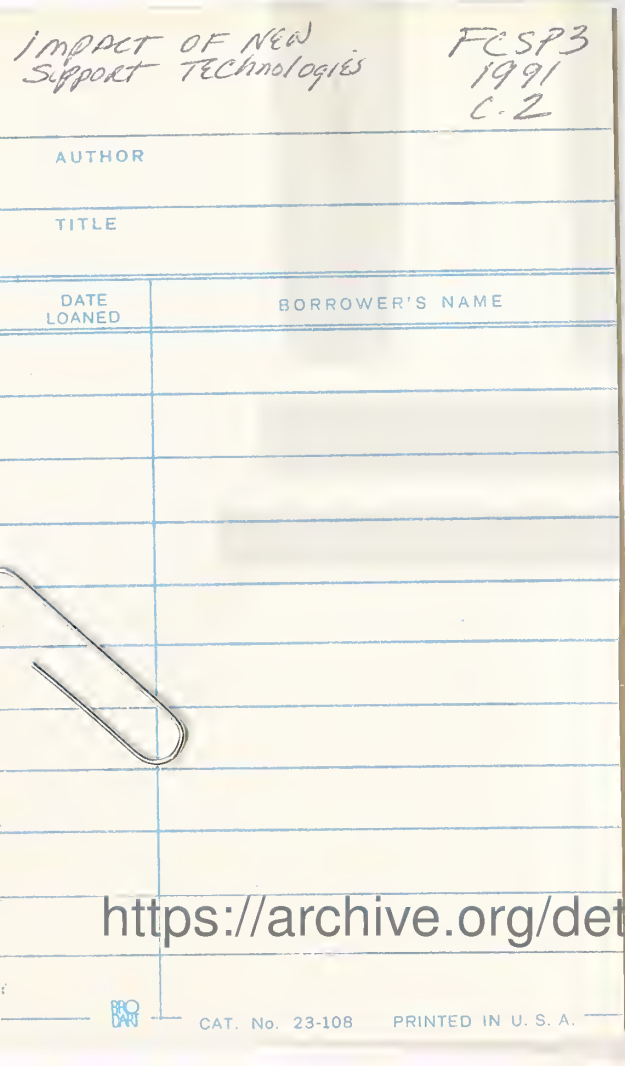
Abstract

This report examines new technologies and concepts being implemented by customer service organizations to improve service delivery and enhance operational effectiveness. These new support technologies generally fall into two categories: those that improve service quality and those that improve profitability by maximizing resources. The primary development in new support technologies is of the field service information system (FSIS)—a set of applications that incorporates computing, data base and network capabilities as well as more specialized technologies such as remote diagnostics, AI and mobile communications networks to render data transfer, extraction and manipulation more efficient.

The report discusses FSISs in detail and other emerging support technologies. Certain levels of receptivity, size and service volume are required to enable these new technologies to take hold, which are currently visible among a "vanguard" of manufacturer-owned service organizations and ISOs. Understanding and selective implementation of FSIS and related technologies can lead to significant cost savings and value-adding benefits for vendors.

The report contains 86 pages and 25 exhibits.



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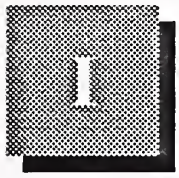


Introduction

A
Purpose and Scope

This 1991 INPUT CSP Issue Report examines the technologies and operational concepts that are being used by customer service organizations to improve delivered services and overall operational effectiveness.

The primary development in new service support technologies is the utilization of integrated Field Service Information Systems (FSIS). The definition and assessment of FSIS will constitute the major direction of this report, as it is the implementation of FSIS that enables the use of other technologies in service delivery.

This report was designed to answer the following questions regarding new support technologies:

- What are the identifiable support technologies available to the vendor? What technologies are actively being implemented in the vendor community?
- What operational changes are being developed to assimilate these technologies?
- What organizational intelligence level is becoming the new competitive standard? What currently constitutes a "Me Too" technology?
- What benefits does the vendor receive from these support technologies?

B
Methodology

This report is based upon structured telephone interviews with 30 end users and 20 service vendors. Sampling was distributed across geographic and industry segments. The overall study methodology was designed to provide insight into how certain concepts and trends were being accepted and implemented within the computer and information services marketplace.

Exhibit I-1 provides the demographics of the user respondents. Although a modest majority are manufacturing companies, the sample does represent the dominant vertical sectors used by INPUT in its industry-specific market definitions.

EXHIBIT I-1

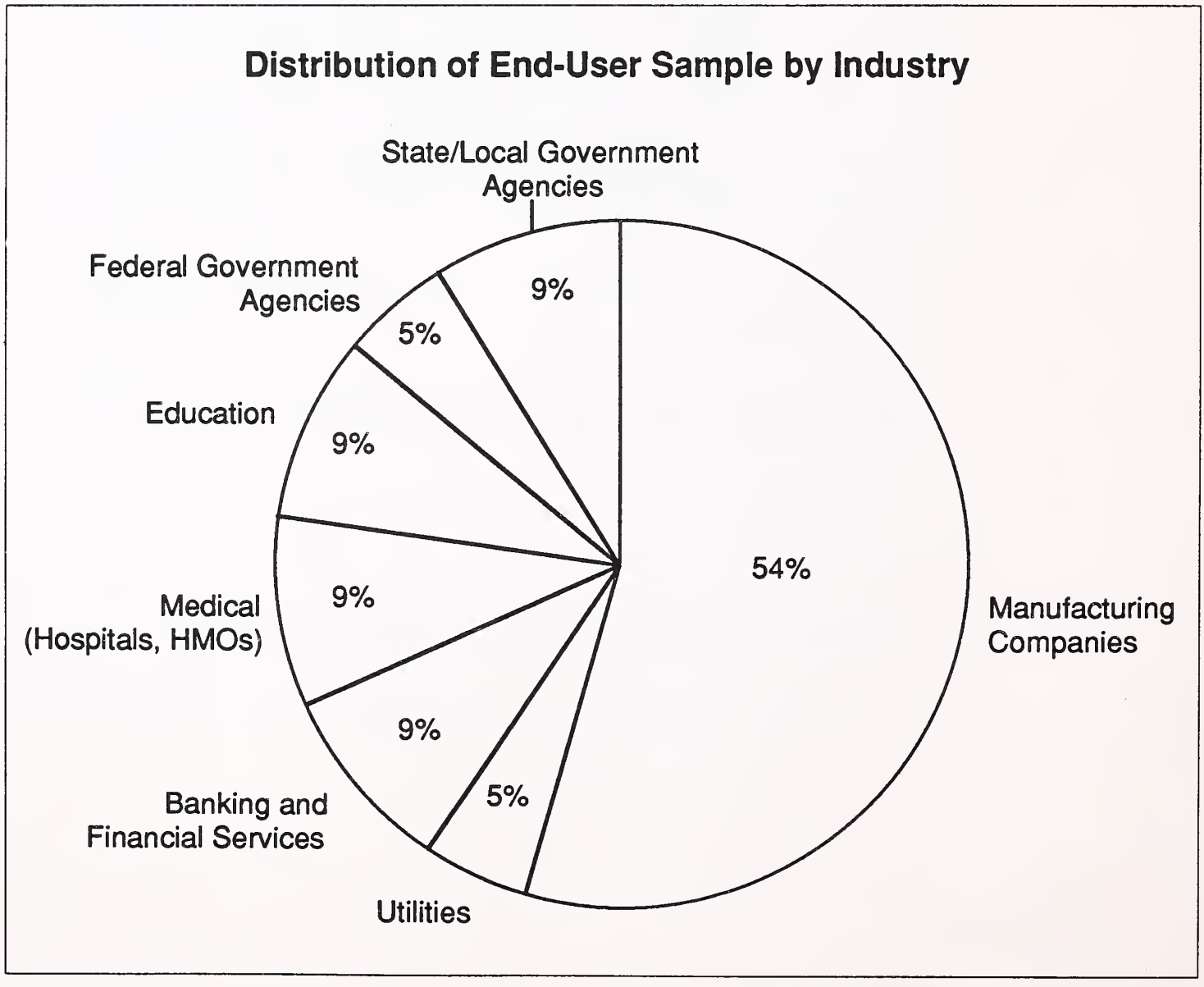
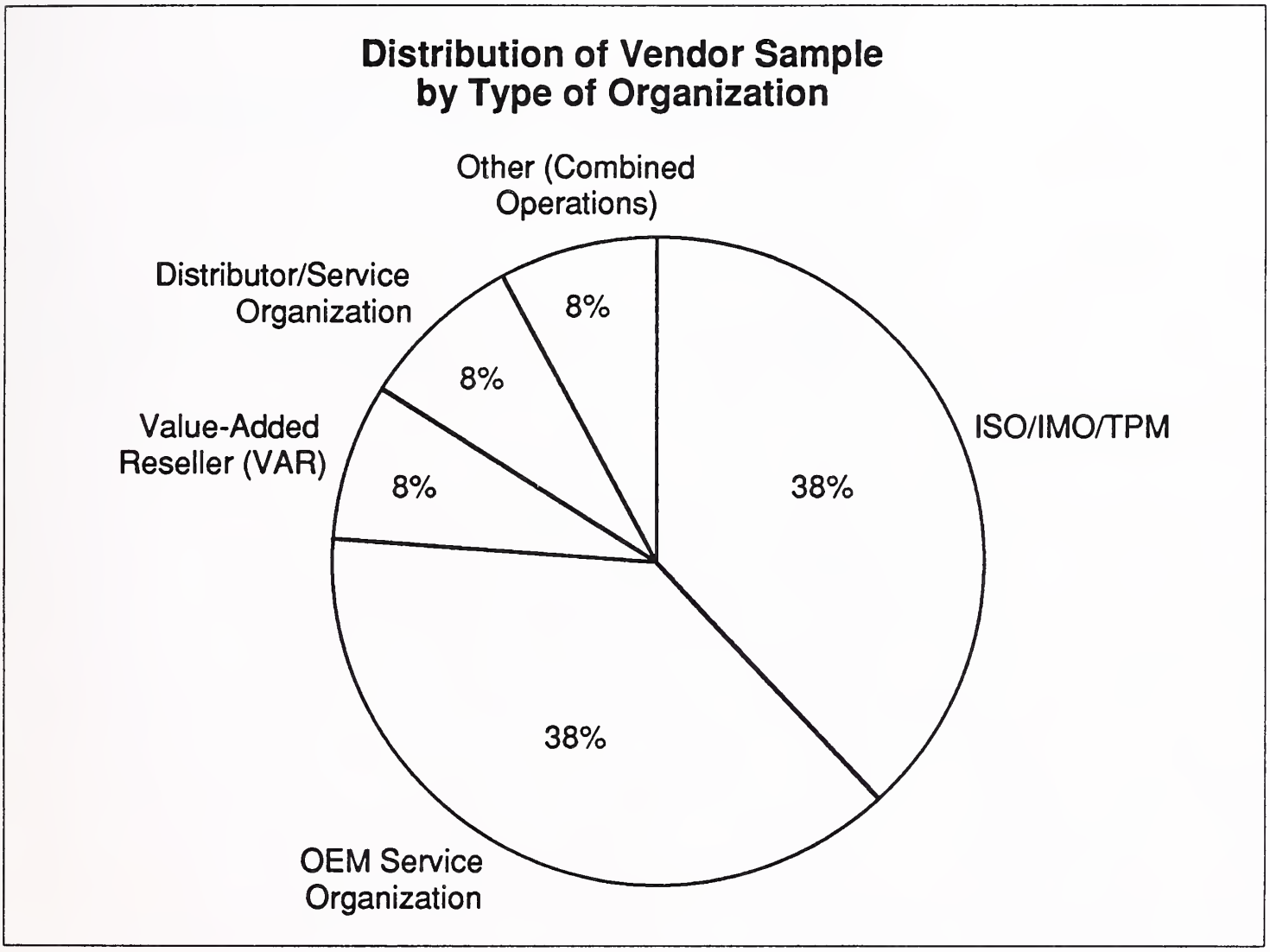


Exhibit I-2 provides the demographics of the vendor respondents. This sample represents the demographics of the customer services industry in general.

EXHIBIT I-2



C
Report Organization

Following the introduction, this report is arranged as follows:

- Chapter I—Introduction—Statement of study purpose and methods
- Chapter II—Executive Overview—Provides a brief summary of the report's findings and recommendations
- Chapter III—Stages of Evolution in the Computer and Information Services Market—Examines innovation as reaction to user demand

- Chapter IV—FSIS—Foundation for Technology Implementation in the Service Organization—Provides a detailed survey of new support technologies, focusing on the concept of field service information systems
- Chapter V—Vendor/Competitive Assessment—Investigates the current implementation status of the technologies under discussion and assesses their benefits
- Chapter VI—Conclusions and Recommendations—Suggested methods for assessing new technologies within the service organization

D
Related Reports

The topics covered in this report and in related issue reports in the INPUT Customer Service Plus Program have been identified as a priority issue by the FCCSP subscribers.

Related reports include:

- *U.S. Customer Services Market, 1991-1996*
- *Innovative Service Offerings*
- *Single-Point-of-Contact Customer Services*

Executive Overview

II

Executive Overview

A
Introduction

This FCSP Issue Report, *Impact of New Support Technologies*, investigates ways vendors are adjusting their operations and the technologies that are being utilized to respond to user demand escalation and to improve competitive effectiveness.

Technologies implemented by service organizations to effect operational improvement may be classified under two general themes:

- Those that enable the vendor to deliver various service products in a manner that is sensitive to, and meets or exceeds end-user expectations and requirements for response, mean time to repair (MTTR), quality, etc.

- Those that gain maximum profitability by reducing operational costs and increasing field organization utilization, control and optimization of inventory stocking and movement, etc.

B
FSIS: Foundation for Technology Implementation in the Service Organization

The primary framework for technology development and implementation in service organizations has been through the concept of a field service information system (FSIS).

FSIS applications, whether commercially packaged or developed on a custom or in-house basis, support the information processing requirements necessary to complete a given service transaction. Typically, the structures of these systems follow functional definitions, providing integrated categorical support for:

- Call handling and dispatch management
- Technical assistance
- Inventory and logistics control
- Customer information file management
- Service billing/contract management

An important function inherent in the overall management of information within the FSIS concept is a data base management subsystem (DBMS) that enables comprehensive information transfer throughout the organization and coherent data extraction and manipulation.

The technologies that come together to produce the FSIS capability include all available computing, data base, and networking options. Recent developments include the more specialized technologies of:

- Remote diagnostics
- Artificial intelligence-based expert systems
- Response center/help desk applications
- Mobile communications networks

Many of these technologies are used in combination and cannot be easily assessed individually. Each has a definite impact on the way a service organization is able to retrieve, use, and distribute available information for best effect.

Other technologies being implemented within the service operation include digitized maps, caller identification, CD ROM, and multimedia applications.

C
Benefits of FSIS/Technology Implementation

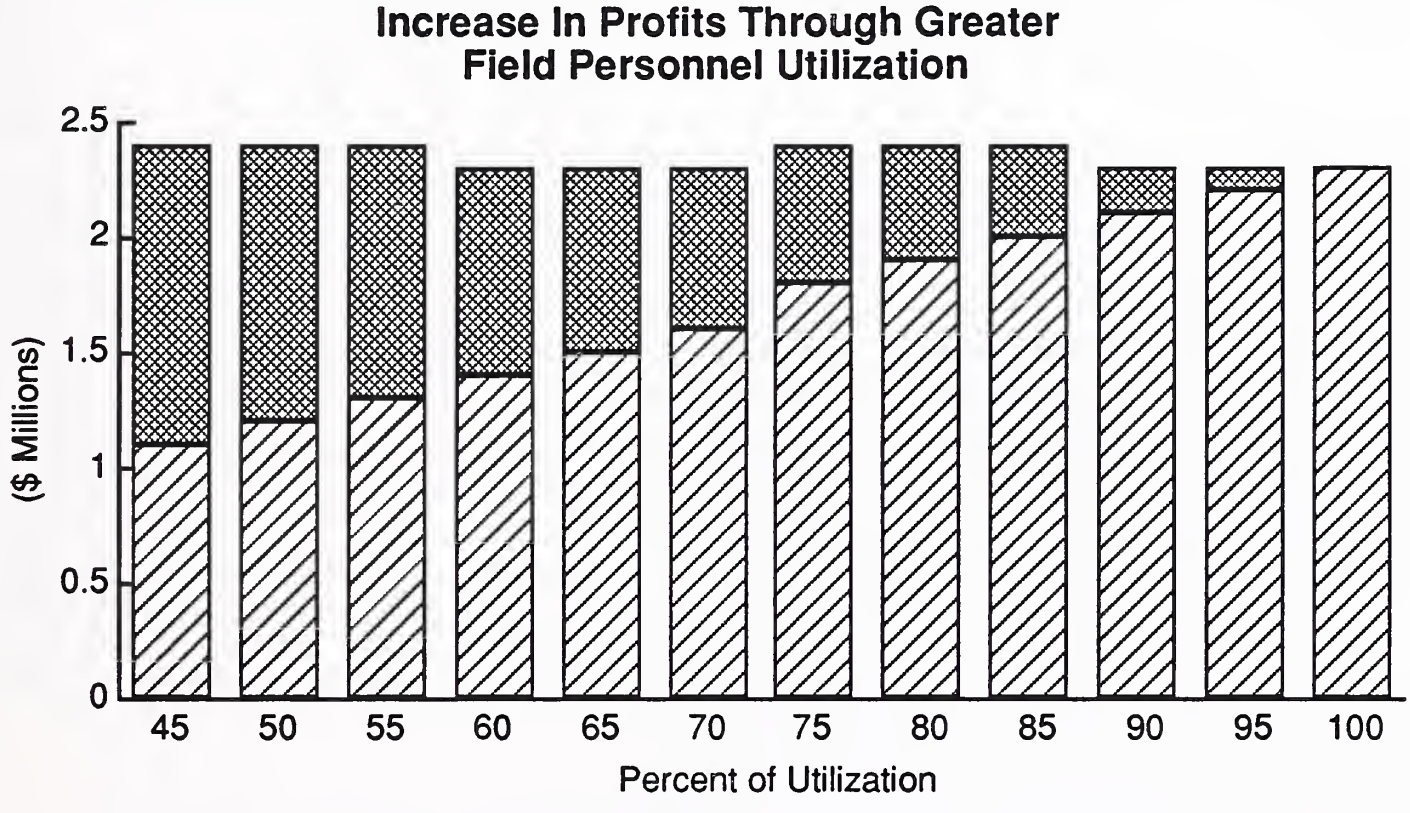
Benefits appear in two ways when implementing the technologies discussed here.

- First there is the refinement of the real-time service operation, that uses and distributes information in a way that produces value—in shorter response times, in more accurate diagnosis, and in communicating customer needs in a more precise way.

- Second, they provide a medium in which to capture information and data regarding service call histories, product reliability, maintainability, MTTR, MTBF, and organization operating parameters—all of which can be used within and without the formal service organization.

Exhibit II-1 examines the first benefit concept by illustrating profitability changes associated with a greater degree of field personnel utilization. Previous studies assessing the service industry have estimated that, on average, a field service organization operates at a 55% utilization rate—that is, the average service operation is able to bill only 55% of the available field engineer hours. In the model presented in Exhibit II-1, a 5% increase in utilization can produce an additional $1.17 million in realized profits. A primary contributor to the increase in field utilization is the competent use of diagnostic methods and call assignment procedures that investigate dispatch avoidance alternatives.

EXHIBIT II-1

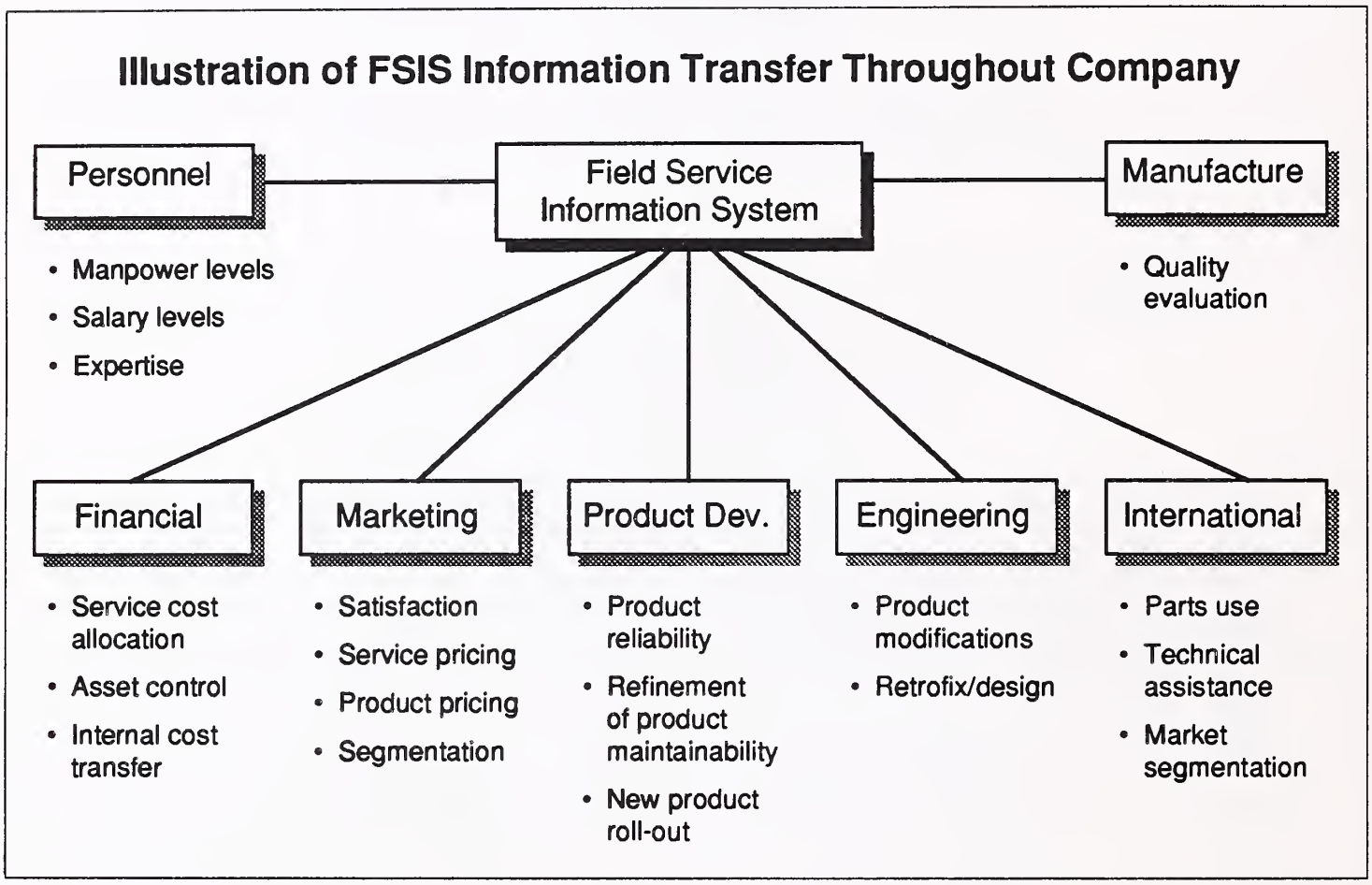


Footnote: Model Assumptions: FEs = 500; 2080 FE Hours/Year;
Gross Profit 25% from $90/Hour Billed

The thorough use of the raw data and information generated by the implementation of an FSIS and/or any of the automated functions that fall under the FSIS "umbrella" can produce value for many aspects of the extended service organization: marketing, competitive analysis, cost/contribution analysis, and—for the manufacturing organization—quality control, product design, and product development.

Exhibit II-2 provides an example of where the information generated by the service operation can be assimilated into other functions.

EXHIBIT II-2



D

Vendor Assessment/Implementation Status

All of the vendors surveyed indicate that they have implemented a field service information system (FSIS) and currently operate this system in their day-to-day service operations.

Interviews with equipment and systems suppliers suggest a significant lag in the service vendor community in implementing integrated information systems and new related technologies.

Several FSIS applications vendors have indicated that there is a "vanguard" of companies active in implementing new operations and systems technologies. Other companies appear to implement such technologies on an ad hoc or "me too" basis, but only when it is evident that the investment will produce an acceptable level of return and additional value, and/or when it is evident that the technologies are creating an unbalanced competitive situation.

Larger service organizations associated with companies having significant internal resources, such as IBM, DEC, NCR, Bell Atlantic Business Services, and other primary players in the industry and its various segments, are typically at the forefront of implementing new technologies.

There is a significant lag in the implementation of advanced technologies in the overall computer and information services market. The same "vanguard" of OEM and large ISO service organizations is active in developing operational diagnostic and AI applications to enhance service capability. Outside of this vanguard the economies of scale do not allow the investment necessary to implement such programs.

Exhibit II-3 provides a summary of FSIS and advanced technology implementation activity suggested by the general market assessment and study results.

EXHIBIT II-3A

Summary of FSIS/Support Technology Utilization

Support Technology	ISO/IMO/TPM	OEM	Comments
FSIS - Umbrella • Call handling & dispatch • Logistics & inventory • Service billing/financial • Customer info. file/data base DBMS - Integration of FSIS data/information structure	• Utilization estimated tobe approx. 12% to 20%	• Utilization estimated to be approx. 25% to 30% • Capacity for creating added value due to FSIS information looped back into product engineering and manufacturing processes	• Major ISOs (Intelogic Trace, Decision Data, Control Data, BABS—which comprise over 45% of the ISO/TPM market) have well-established FSIS and functional integration. Remainder of ISO segment is inconsistent in FSIS implementation development and integration. • Typically, CHAD is the primary channel for automation and overall FSIS development. • CIF/DB is built, reactively, from existing data points. Proactive or "by design" data retrieval and allocation and data base performance issues represent current development areas. • Packaged FSIS applications represent industry benchmark. However, OEM use and development of advanced technology applications will remain as state of the art.

EXHIBIT II-3B

Summary of FSIS/Support Technology Utilization

Support Technology	ISO/IMO/TPM	OEM	Comments
Remote access/remote diagnostics	• Proprietary diagnostic software available through licensing and strategic partnering • Developed through reverse engineering efforts	• OEM has significant advantage via "by design" development of embedded diagnostic programs and proprietary access/fault isolation	• Embedded diagnostics with remote access establishes proactive posture by enabling the capability for real-time fault indication • The strong market movement toward software and system/network control services reinforces the importance of real-time remote diagnostics, access, and repair methods and applications
Artificial intelligence	• Vanguard technology within both ISO and OEM segments		• Active as conceptual technology; however, actual implementation has been characterized by narrowly-defined applications • State of the art in AI development sees more general applications in self-organizing, intelligent data base, data linkage, and interface methodologies • Available AI "shells" provide access to development architectures
Mobile data communications	• Third-party mobile data network operators enable cost-efficient implementation options. (RAM, ARDIS (Motorola))		• Data transfer between FE and dispatch center (TAC), whether real-time or selective up/down load, can significantly contribute to increased field labor utilization rates by reducing FE unbillable "downtime" • State of the art focuses on portable computing technology to enable levels of decentralized data manipulation, storage, and retrieval, giving more of the problem-solving power and responsibility to the on-site FE • Mobile systems integration vendors (Motorola, Sears Business Systems, Ericcson) facilitate mobile configuration design and maintenance

The technologies under the FSIS umbrella have been implemented and designed to refine and optimize the day-to-day operation of the field service organization. The study results indicate that "traditional" services that focus on maintenance and repair tasks still represent the majority (approximately 85%-90%) of revenues for service organizations. There is evidence in the existence of new start-ups and changing organizational structures that this predominance of "traditional" services in generating revenues and profits will slowly erode.

As the product mixture of the service organization evolves to include more professional and ancillary services, new functions will need to be considered to deal with the economics and project-oriented nature of these activities.

The advantages to implementing the technologies discussed in this report are many. Cost savings and value-adding benefits can be achieved with the prudent implementation of these technologies within the FSIS concept. To balance the debate we must identify the disadvantages of implementing these mechanisms:

- Significant investment
- Increased dependence on these technologies for service call resolution, reducing the reliance on experienced human field engineers. User perceptions of "personal" service may be negatively affected.
- Capacity for "cookbook" mentality in service delivery, contributing to limited understanding of underlying system characteristics

E
Summary Conclusions and Recommendations

Recommendations about which technology will produce significant results in any given service organization are impossible and imprudent.

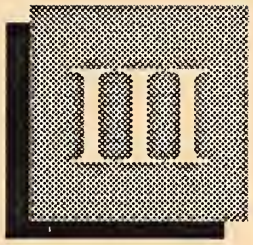
In considering new support technologies:

- The implementation of an FSIS must be done with the knowledge that the system will have an impact on the way the organization does business on an operational level.
  - The challenge is to implement the technologies while maintaining operations and practices that have worked for the service organization.

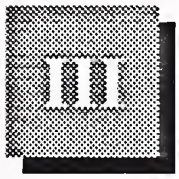
- Conversely, companies should be prepared to change the operational characteristics of their service organizations when it is recognized that new, usable information is retrievable through the FSIS, and can be leveraged into additional service products and/or value-adding procedures.

- The most important concept to understand regarding support technologies is that these concepts produce *control* of the service function. Control enables the competent adjustment of operating variables to optimize profits *and* to optimize customer/end-user satisfaction.

It is recommended that service managers use the information presented in this report, supported by their own company's operating data, to refine operating estimates, perform analysis on functional interrelationships, and identify performance gaps or inconsistencies that may be refined and improved by FSIS automation and the implementation of new support technologies.



Stages of Evolution in the Computer and Information Services Market



Stages of Evolution in the Computer and Information Services Market

A
Evolutionary Stages

The service vendor wants to leverage its organization's capability of providing an excellent service portfolio for high profit. The perfect scenario for the vendor is to sell the capability of providing that portfolio on a long-term contract basis while never having to actually deliver that capability to the end user. There would be little or no cost for the service operation, only the collection of contract fees.

This scenario is unrealistic. However, increasing the effectiveness of the service delivery infrastructure that is required in order to offer a competitive service portfolio brings the vendor closer to this ideal.

Changes in the characteristics of user demand drive the service organization to innovate and to improve its products and operating methods. These improvements in turn can generate new and sometimes unanticipated user demands that act as a catalyst for this cycle to begin again.

Exhibits III-1, III-2, and III-3 provide a loose model of the overall service market with regard to user demand, economic influences, and vendor innovation. This model appears as presented in other reports in the INPUT Customer Service Plus Issue Report Series; references and surrounding text are specific to this report.

EXHIBIT III-1

Traditional Aspects of Service

- Service Market Characteristics
  - On-call OEM service
  - Reactive service infrastructure
  - Warranty service
  - Time and materials
- Service Contract Issues
  - Preventive maintenance
  - Emergency repair
  - Standardized hours/availability

EXHIBIT III-2

Evolution into ISO/IMO Competition

- Service Market Characteristics
  - Service portfolio defined by end-user requirements
  - Cost competition
  - Sales emphasis on education of end user to values of service
  - Evolution of service contract as primary profit generator
- Service Contract Issues
  - Restructuring of contracts in response to VMS demands
  - Response times, first visit fixes are primary user issues
- Internal Operations
  - Refinement of inventory controls, just-in-time methods
  - Development of real-time call handling concepts
  - Focus upon increasing revenues per field engineer

EXHIBIT III-3

Application/Technology-Driven Service Market

- Service Market Characteristics
  - Traditional aspects plateaued/margins being squeezed
  - Leverage relevant expertise to expanded service products
  - Leveraging expertise into niche and cross-industry markets
- Service Contract Issues
  - Decisions focusing on bundling/unbundling of services
  - Roll-out of value-adding professional/ ancillary services
- Internal Operations
  - Development/implementaion of real-time response capabilities
  - Implementation of problem/resolution information pipeline
  - Overall development of a proactive service infrastructure

Exhibit III-1 itemizes the service relationship that traditionally existed within a product-oriented organization. Product differentiation was the basis of market competition, and product margins were high enough to deserve priority. Service was seen as a necessary cost of selling the product. Warranty obligations were the surrogate for modern service contracts.

Service demand in the context of Exhibit III-1 was generated by traditional hardware-based maintenance and repair. Aggregate demand was primarily a function of the number of units operating within the market and the Mean Time Between Failure (MTBF) characteristics for that total installed base.

Exhibit III-2 shows how the industry has evolved into a buyers' market, the service end user having the advantages of high service/product substitution, a relatively low cost for switching vendors, and a high level of information regarding the types of services available and the composition of the services required. This environment causes tremendous pressure on service vendors to differentiate the services they provide and to increase the price/performance of their service portfolio.

Exhibit III-3 displays the types of maneuvers currently being designed and implemented by vendors to gain market advantage.

As the information systems marketplace moves toward and displays more of the characteristics associated with a solutions-driven market, there is a marked increase in the specific demands end users make on their service vendors for a higher level of content and quality in the delivered services per dollar.

The pattern of "demand escalation" evident in the model is amplified by new product technologies and an overall increase in user dependence on information processing in daily functions.

B

Importance of Features

Currently, the basic service portfolio provided to the end user features a variety of service items in addition to the provision of parts and labor. The most important of these deal with the response capabilities and availability of the field representative and the service organization in general.

When asked if they receive these individual service items from vendors as part of their service agreement(s), users indicated that there are specific items that are not consistently delivered in the industry.

Exhibit III-4 indicates which service items are being underdelivered by vendors. The ability to provide users with an uptime guarantee for their installed base, the availability of a full-time on-site field engineer, and a guaranteed one-hour response time rank in the top of this category.

EXHIBIT III-4

Profile of Service Features—End-User Rating of Importance by Percent Delivered

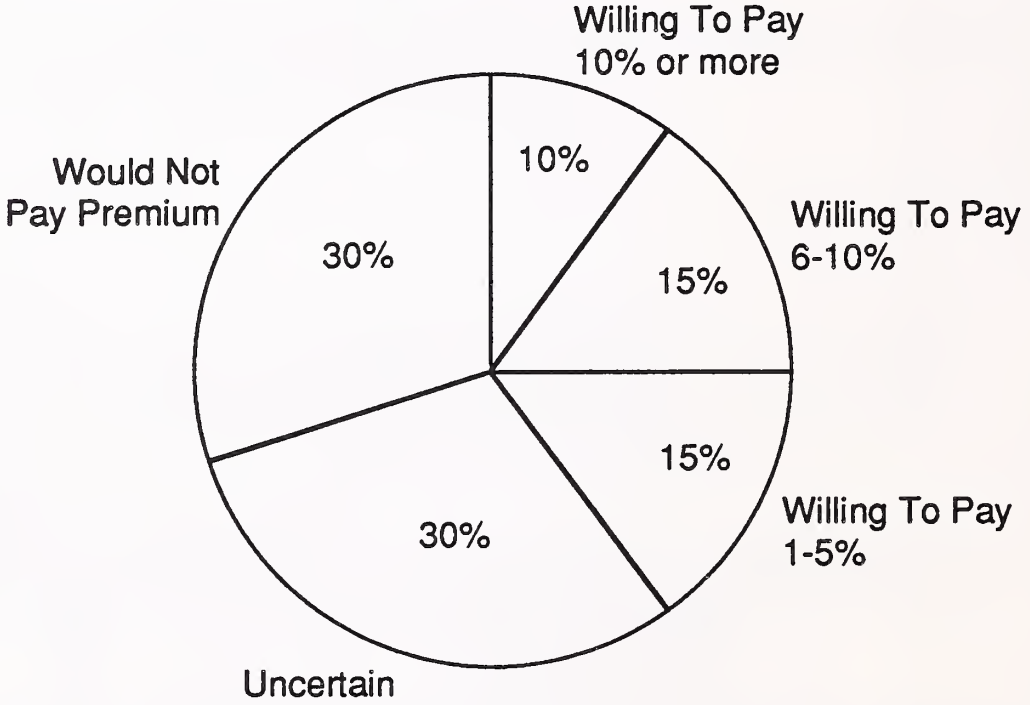
Legend No.	Service Feature	Mean Rating of Importance	End-User Receiving Feature (Percent)
6	4 Hour Guar. Response	4.7	52
2	On-site Field Engineer	4.7	19
1	Uptime Guarantee	4.5	10
3	1 Hour Guar. Response	4.5	19
7	2 Hour Guar. Response	4.5	57
5	MicroCode Diagnostics	4.3	43
9	7-Day /24-Hour Service	4.2	62
12	Unlimited Service Calls	4.2	81
10	Loaner/Replacement Units	4.1	67
13	Preventive Maintenance	4.1	86
14	Telephone Support	3.9	86
8	Remote H/W Diagnostics	3.8	52
4	Depot Service	3.6	29
11	Remote S/W Diagnostics	3.4	57
15	Install/Moves/Adds	3.4	76

- INPUT asked end users how much more they would be willing to pay to receive the exact features and levels of service and support they require for their specific systems and operations. In response, as shown in Exhibit III-5, it was found that there exists a significant willingness to pay above the existing fee levels.

- Historically, this has translated into the packaging of services to cater to the specific needs of various vertical market segments. Of note, roughly one-third of the users voiced doubt that any single vendor or combination of vendors could provide exactly the services and quality that they required.

EXHIBIT III-5

End-User Willingness to Pay a Premium (WTP) for Delivery of Exactly Tailored Service Needs and Requirements



Vendors that incorporate operational or systematic changes that facilitate the delivery of a valuable service product mix—focusing upon response sensitivity and technical expertise—will be able to recoup the costs of these changes within a one- to three-year timeframe. Larger field organizations are more likely to see a shorter ROI on such investments.

A growing characteristic of the end-user community is a perception that the vendor is an active conduit in a "help me" versus a "fix me" service arrangement. In effect, this relationship would transfer some of the responsibility for the ultimate delivery of service to the user, reducing some of the traditional emphasis on the vendor's service capability, and fueling the expansion of the service portfolio into "softer" services.

It is unclear how the economic and financial differences of newly developed and evolving professional and project-oriented service products will affect the organization of service companies. Allocation and selection of human resources within the actual field service operation will become an increasingly important issue for contemporary managers.

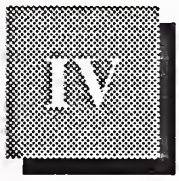
With all these considerations, technologies implemented by the service organization may be classified under two general headings:

- Those that enable vendors to deliver various service products in a manner that is sensitive to, and meets or exceeds end-user expectations and requirements for response, mean time to repair (MTTR), quality, etc.

- Those that gain maximum profitability by reducing operational costs, increasing field organization utilization and control, and optimizing inventory stocking and movement, etc.

This report, *Impact of New Support Technologies*, investigates how vendors are adjusting their operations and what technologies are being utilized to respond to user demand escalation and to improve competitive effectiveness.

FSIS—Foundation for Technology Implementation in the Service Organization



FSIS—Foundation for Technology Implementation in the Service Organization

A
Definition

The primary framework for technology development and implementation in service organizations has been through the concept of a Field Service Information System (FSIS).

This catch-all label encompasses an entire classification of systems applications and operational technologies designed to provide service management with a high level of control over the service delivery infrastructure. These applications and technologies provide comprehensive data on operating characteristics and methods for using generated information to further refine the service operation and product.

In achieving any level of the operational intelligence implied by the FSIS umbrella, three types of resources are required to be managed effectively:

- Operations data
- Personnel
- Material/logistics

Historically, data regarding performance and the operating characteristics of these three resource categories throughout the entire service organization was compartmentalized and rarely analyzed in a coherent way to assess the interrelationships between the various departments or functions.

Data may have been retrieved and performance compared to historic or forecast conclusions, but the day-to-day characteristics of operating a service organization were not truly studied or understood. This attention occurred only when the profit-generating characteristics of the service function were assessed.

Virtually all of the current activity in the development of new support technologies is aimed at the refinement and optimization of data entry, data access, data management, data analysis, and data presentation. Ironically, computer/information services vendors are developing the same dependency upon information processing as the end users they serve. The greater the vendor's skill in extracting value from the available data, the greater that vendor's capability of delivering a salable and profitable service portfolio.

B

State of the Practice in FSIS

FSIS applications, whether commercially packaged or developed on a custom or in-house basis, support the information processing requirements necessary to complete a given service transaction. Typically, the structures of these systems follow functional definitions, providing integrated support for service. Exhibit IV-1 provides a reference of the functional components addressed by these systems and suggests the sequential support requirements of the service operation.

Appendix B provides a more detailed illustration of the line-item functions associated with these support components.

Call Handling and Dispatch Management supports the reception, evaluation, and appropriate assignment of the User's Service Request (USR). Data collected, accessed and organized within this function controls much of the downline resource allocation within the field organization.

USR assignment includes the assessment of any available diagnostic information and/or any requisite transfer to diagnostic analysis methodologies.

Initially developed independently from the FSIS concept, Technical Assistance Centers (TACs) act as the "front line" in the assessment and resolution of service problems. In operation there is no clear delineation between the TAC and a mature Call Handling and Dispatch function normally associated with the FSIS umbrella. The TAC is developed as a problem/resolution resource, typically utilizing data base technologies to enter, organize, retrieve, and generate information concerning an end-user problem.

EXHIBIT IV-1

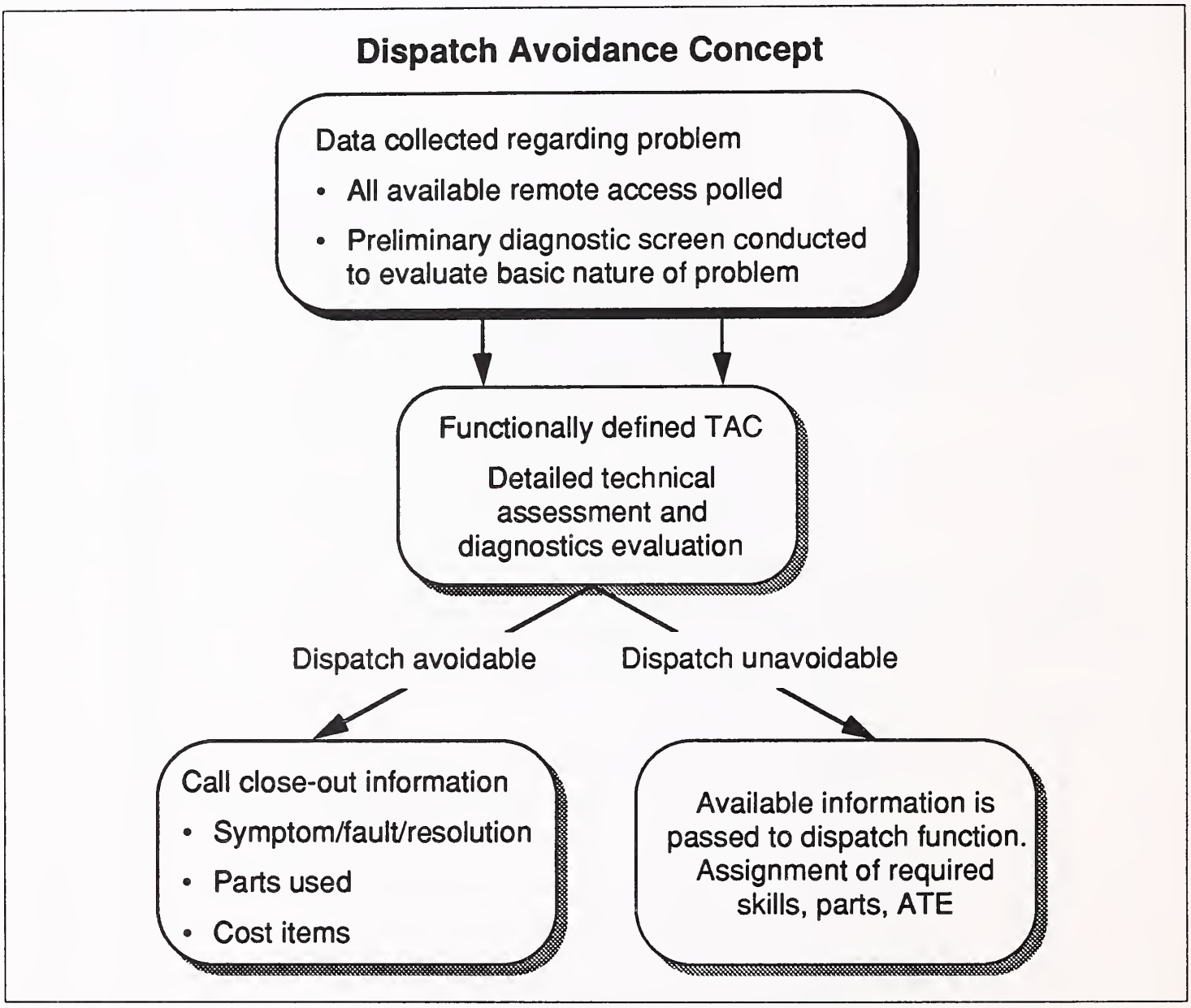
Major FSIS Support Components

- Call handling and dispatch management (Technical assistance and dispatch avoidance inclusive)
  - Call opening/reception
  - Call assignment
  - Call escalation
  - Call closure
- Preventive maintenance; project planning; management of professional and ancillary services
- Inventory and logistics control
  - Order entry processing
  - Order status/query
  - Backorder management
  - Inventory movement
  - Forecasting
  - Distributor/partner management
  - Parts master file/data base
- Customer information file management (MIS requirements)
  - Reporting
  - CIF/data base file organization
- Service billing/contract management
  - Purchasing
  - Accounting
  - Financial controls
  - Contract management

Diagnostic mechanisms, whether embedded in the equipment and accessed remotely in the evaluation process, or systematically addressed in the CHAD or TAC query procedures, allow the organization to investigate alternatives to dispatching an FE to the equipment/customer site. In most instances, dispatch avoidance routines (see Exhibit IV-2) can reduce the

costs of call resolution. Industry studies have found that systematic dispatch avoidance procedures can diminish the number of required on-site visits as much as 30%, reducing the high cost of field maintenance and related field support activities.

EXHIBIT IV-2



Service call close-out procedures determine and document the resources used in the service transaction. Labor, parts, and consumables are tallied as well as information regarding the isolated fault, actions taken, and the ultimate resolution. Data entered upon close-out will be a tremendous contribution to the organization's equipment and manpower knowledge base.

Logistics and Inventory Control provides coordination of all parts, tools, ATE units, and consumable resources throughout the service organization, down to the FE trunk/kit level. Adjusted from trending data made available from service call histories, inventory levels can be trimmed to reflect actual usage patterns, reducing the cost requirement of keeping a static inventory based on arbitrary levels.

The Customer Information File and Data Base Management function orchestrates all relevant data regarding the service operation in one or more data base files so that the data can be shared and manipulated by the overall FSIS and the specialized subsystems within the FSIS. Operationally, the Customer Information File Data Base (CIF/DB) gives the ability to produce management reports on the activity of the overall service delivery infrastructure.

Invoicing and Service Billing is designed to ensure reception of full revenues for all services rendered and internal cost transfers. This function will also provide a level of accounting and financial control of the revenue and cost components of the service organization, including profit contribution analysis and contract management.

The underlying technologies for the successful implementation of the FSIS is largely mainstream computer, networking, and data base systems.

An important function inherent in the overall management of information within the FSIS concept is a data base management subsystem (DBMS) that enables comprehensive information transfer throughout the organization and coherent data extraction and manipulation.

The data base structure does not determine the characteristics of the specific functional FSIS categories; however, the data base structure and query language will determine the characteristics of data transfer, tabulation and analysis capabilities, processing speed, and reporting capabilities of the overall FSIS application.

4GL and advanced file management methodologies such as relational formats, coupled with the greatly improved processing speeds of today's computers, allow the development of user friendly applications with extensive data manipulation characteristics. 4GL requires less lines of code, is self-documenting, provides for easier maintenance, and greatly facilitates end-user queries by enabling the use of plain-language descriptors.

In considering FSIS applications, data base issues are crucial in that the FSIS applications program is written "over" a data base system. The application, operating at a higher level, "uses" the data base system to conduct the specific data movements and create the specific data manipulations that define the application's design and purpose.

Vendors of packaged "standardized" FSIS applications are presently delivering products that operate in an open-systems environment. Choices of hardware, operating systems, data base structures/mechanisms, and interface options are being given to the end user.

Previous studies examining the FSIS market have indicated that there has been and should continue to be implementation of standardized FSIS products in midsized and smaller service organizations. Larger organizations, which have traditionally developed such systems in-house or have purchased custom systems, are now being forced to consider FSIS applications packages. The technologies and expertise employed in these packages have evolved to a point where they equal internally developed systems in cost and functionality.

Well-established examples of such packaged FSIS applications include "Dispatch-1" from Applied Systems Technology, "Fieldwatch" from The Data Group, and "OpenUptime" from MiniComputer Software Specialists.

C
Advanced Technology In Use

Interviews with equipment and systems suppliers suggest a significant lag in the service vendor community in implementing integrated information systems and new related technologies.

Several FSIS applications vendors have indicated that there is a "vanguard" of companies active in implementing new operations and systems technologies. Other companies appear to implement such technologies on an ad hoc or "me too" basis, but only when it is evident that the investment will produce an acceptable level of return and additional value, and/or when it is evident that these technologies are creating an unbalanced competitive situation.

Larger service organizations associated with companies having significant internal resources—IBM, DEC, NCR, Bell Atlantic Business Services, and other primary players in the industry and its various segments—are typically at the forefront of implementing new technologies.

As stated in the previous section, the technologies that come together to produce the FSIS capability include all available computing, data base, and networking options. Recent developments include the more specialized technologies of:

- Remote diagnostics
- Artificial intelligence/knowledge-based systems
- Technical assistance/help desk applications
- Mobile communications networks

Many of these technologies are used in concert and cannot be easily assessed individually. Each has a definite impact on the way a service organization is able to retrieve, use, and distribute available information for best effect.

Other technologies being implemented in the service operation include digitized maps, caller identification, CD ROM, and multimedia applications.

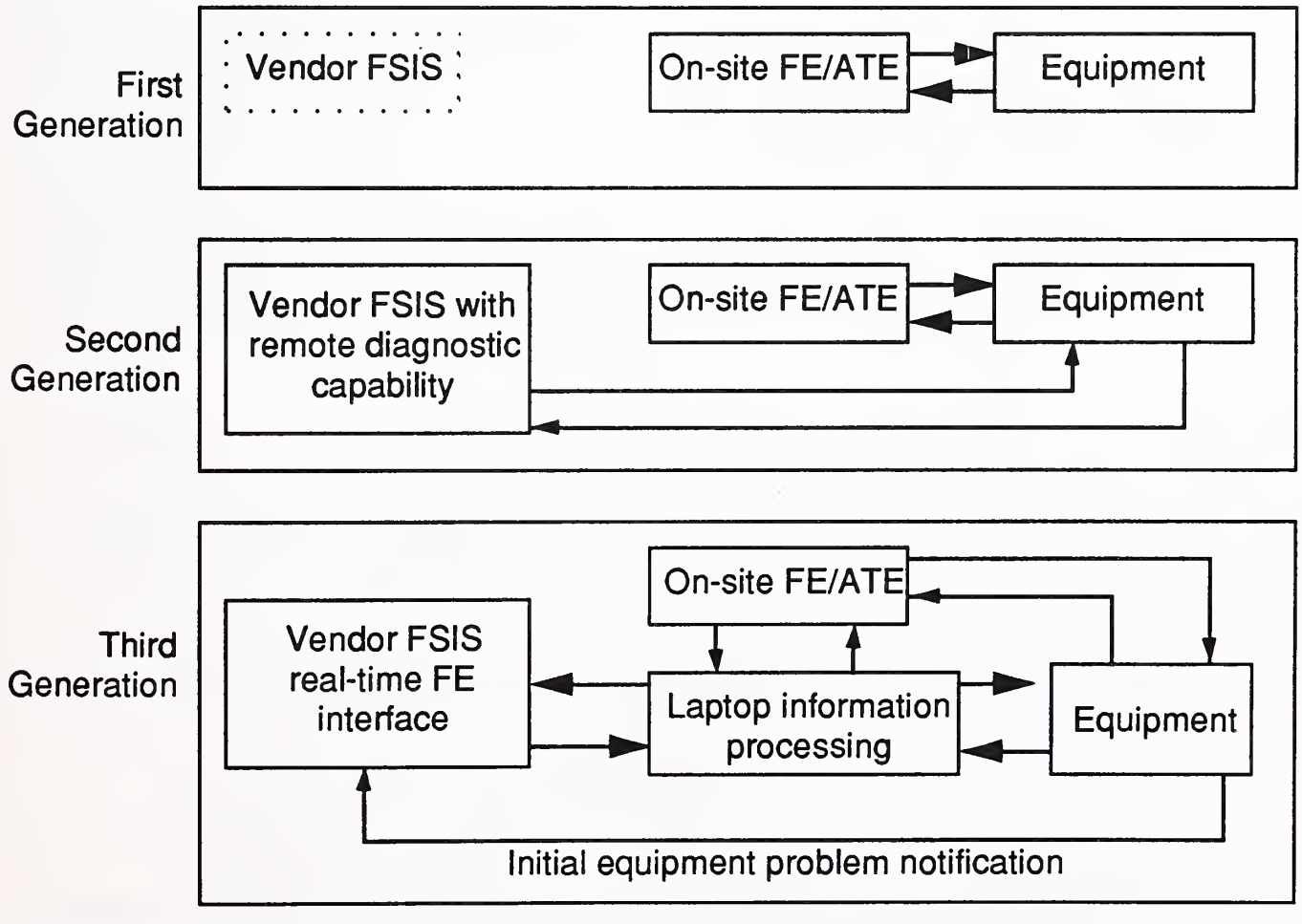
1. Remote Diagnostics

Applications in automated remote hardware and software diagnostics, and advancements in fault-tolerant redundant processor configurations have allowed service vendors to operate with a more proactive approach.

Exhibit IV-3 describes the evolution of remote access and diagnostics in field service events.

EXHIBIT IV-3

Schematic of Remote Diagnostic Information Flow



The first "generation" of remote access was the interaction of the human field engineer with the SUT, assisted by whatever ATE the field engineer had within his/her tool and allocation. All fault indication and diagnostics were accomplished on site, after the fault event. The vendor FSIS is not involved in the real-time diagnostic loop.

The second generation illustrates the development of remote fault indication and a higher level of remote fault isolation. At this level the information transferred to the vendor FSIS enables the vendor to activate assets at the time of the fault event, not depending upon the end user to initiate the service operation.

The third generation of remote access and diagnostics enables the active transfer of fault isolation information between the vendor FSIS, the SUT, and the FE prior to the dispatch of the FE to the site. Actions taken at the service visit and the data retrieved can be integrated into the FSIS data base to refine future diagnostics.

The manufacturers of fault-tolerant computer systems, primarily Stratus and Tandem, have been at the leading edge of remote monitoring, access, and fault correction, and represent full implementation of "third-generation" technologies.

Stratus Computers has so refined this type of methodology that many times the user is unaware that a problem exists until a Stratus representative arrives on site to deliver the required maintenance, or a user-replaceable part arrives.

Stratus has fully incorporated remote access and diagnostics into its service operation. Each Stratus system is fully redundant, and upon any error the duplicate processor or component will be activated, and the systems will communicate the nature of the fault to a 24-hour Stratus service center.

Typically, and by design, the fault is attributable to a user-replaceable board which is delivered to the user the next morning. The FRU is replaced while the system is still in operation and the system automatically tests the new part and brings the component to on-line status. The Stratus service center can then verify the system correction.

The Stratus remote capability extends to dial-in access to the systems when necessary and can perform diagnostics and correction down to the code level.

Operationally, remote access and diagnostics allow the service organization to:

- Reduce the number of on-site service visits by enabling an assessment and initiation of alternative solutions

- Provide the FE with a much higher level of information regarding the service situation and specific problem characteristics. This will reduce the number of repeat visits to complete a given fix.

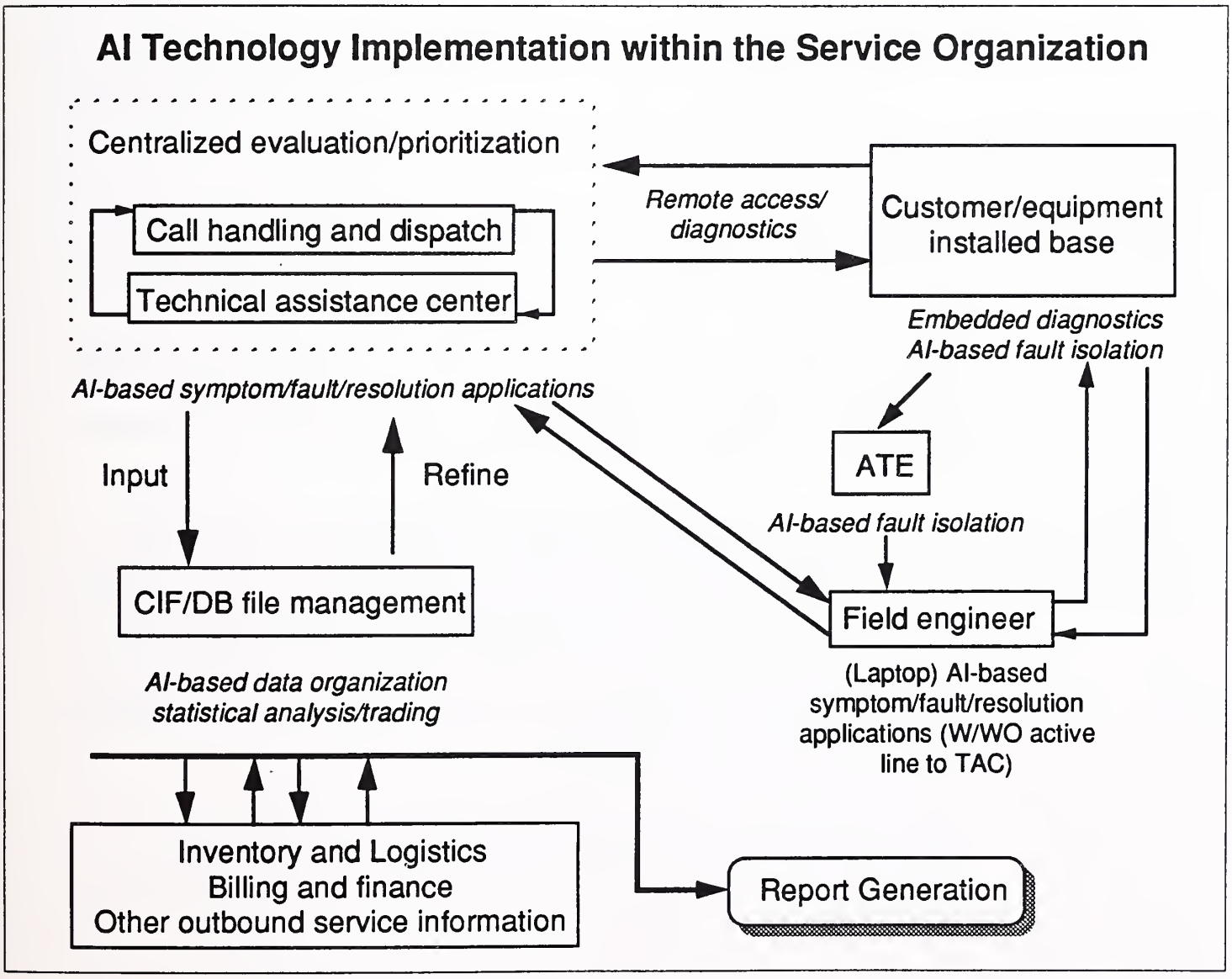
2. Artificial Intelligence (AI)/Knowledge-Based Systems

For the purposes of this report, artificial intelligence (AI) is defined as an application capable of evaluating a multivariable environment on the basis of historical data or on the basis of a given set of rules.

The ability of AI applications to assess the raw data associated with a static or dynamic situation and provide the user with an interpretation of that situation, at a high degree of confidence, provides the service organization with a method of streamlining and automating several functions.

As illustrated in Exhibit IV-4, AI applications can be implemented in a variety of ways within the service operation.

EXHIBIT IV-4



Embedded AI applications can allow single pieces of equipment and networked systems a level of self diagnosis and fault isolation previously unattainable. Teamed with a remote access capability and an interface with a centralized evaluation procedure, embedded AI technology can facilitate call routing and prioritization.

Portable computers and ATE equipment bring AI technology to the equipment / system site, enabling intelligent query of the SUT in much the same way as does an imbedded AI application.

More sophisticated AI-based symptom/fault analysis and solution identification applications are typically utilized within the TAC environment. Mobile communications and portable computing technologies provide an active conduit to the field engineer, allowing a very high level of real-time information transfer from the field to the service knowledge base as defined by the CIF/DB.

The internal methodologies of AI applications may be defined as two different decision architectures:

- Model or rules-based systems that are developed to serve a specific problem or equipment type. These applications are derived from pre-existing knowledge of the SUT and automate the step-by-step processes of fault isolation and corrective action.

- Self-organizing data base systems that catalog the details of service transactions and assess the historical and statistical linkages between accumulated symptom/fault/resolution scenarios. Solutions are derived from historical precedent and/or the assessment of fault probability.

Though model and rules-based systems have been used by manufacturers to diagnose specific equipment classes, the dedicated—and often proprietary—nature of these systems has not encouraged widespread use in the general industry.

Self-organizing data base systems provide statistically sensitive links between recorded fault characteristics and successful solutions. In practice, information entered at call close-out regarding all failure characteristics and actions taken, parts and consumables used, etc. is organized to provide a reference for the next time that particular failure occurs. As the system accumulates service call histories, statistically significant symptom/fault/resolution relationships will become evident for each individual category (and piece) of equipment.

In this manner the service organization can develop extremely accurate failure and performance profiles on its installed base of equipment. Indeed, several ISOs have been able to establish reliable profiles on the OEM products they service.

The simple "thought process" associated with self-organizing data bases makes these systems fairly easy to design and implement. More sophisticated systems typically incorporate statistical and operations-based analysis to provide optimized solutions based on costs of resources, least-time scenarios, and situation-specific service call priorities.

Hierarchical classification is a self-organizing problem-solving methodology, based on a decision-tree concept, which treats diagnosis as a matching of the present problem against established fault requisites.

The advantage of the classification architecture is its ability to work with erroneous or missing data.

Each step in the hierarchy produces knowledge about the conditions under which the malfunction hypothesis it represents is plausible. Each step is a small intelligent program that evaluates whether the malfunction hypothesis it represents is present, given the current data.

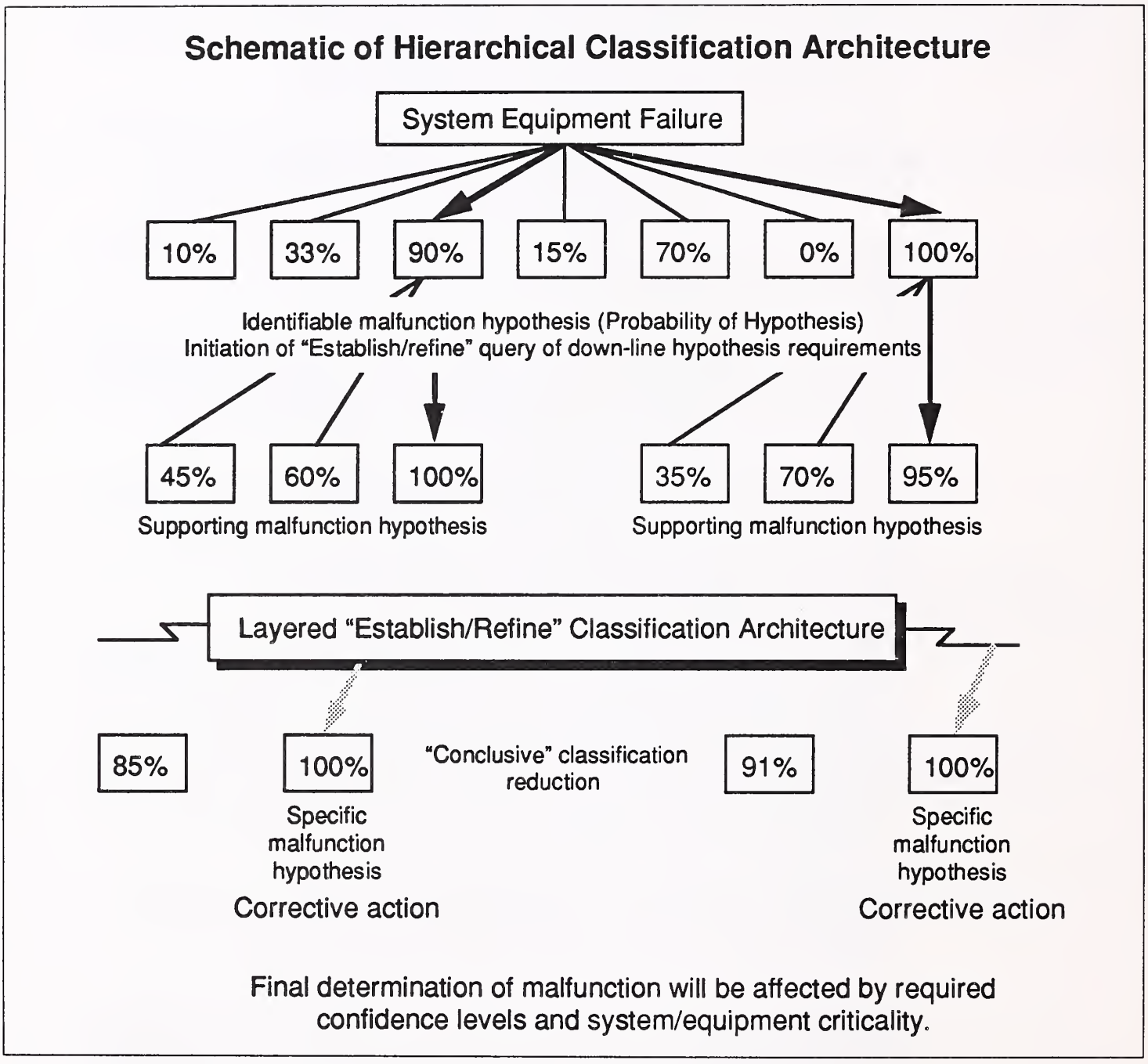
The result of the comparison between the hypothesis and an actual failure is an indication of the probability that a particular malfunction has occurred. As more of the features of a particular malfunction hypothesis are filled, the more certain that particular failure becomes.

The hierarchical classification architecture employs a control strategy of "establish/refine," as shown in Exhibit IV-5. At each step the probability of that malfunction is assessed, given the available data. If all the conditions of the malfunction hypothesis that a step represents are met, that malfunction is judged as likely. At this point, each down-line step is queried and attempts are made to implement it. If a step is found to be unlikely, then that step and other down-line steps are ruled out.

If there is a lack of "fit" between the malfunction hypothesis and the available data, or if different steps do not establish a solution due to common values, then that value is flagged as questionable.

What occurs in this type of system is that a conclusion can be reached much more quickly, even with absent or erroneous data. If available data, for example, represents a 90% match (confidence level) to an available malfunction hypothesis, corrective action can be taken.

EXHIBIT IV-5



The benefits of implementing AI technology in the service organization pivot on the capability of these applications to quickly produce an accurate fault assessment. Operationally this enables:

- Reduction in mean time to repair (MTTR)
- Improved resource allocation:
  - Manpower/skill levels
  - Tools/ATE
  - Spares inventory
- Faster overall response times

Much of the cutting-edge work in AI is represented in academic institutions and the efforts of specialized industrial research and development organizations.

AI technology is available to the vendor as developmental "shells" and is integrated into some of the commercially developed software packages developed for FSIS, help desk applications, and data base organization.

3. Mobile Communications Networks

The ability to transfer information to and from personnel in the field provides the ability for the service organization to:

- Increase billable FE man-hours by reducing administrative downtime
- Distribute the "intelligence" of any operating FSIS functions to the field personnel.

As shown in Exhibit IV-6, advances in cellular communications and the increased capabilities in portable computing power have enabled organizations to distribute information and data regarding call scheduling, prioritization, and escalation contingencies. Data interchange regarding service call specifics, e.g., available diagnostic information, equipment service histories, and call close-out data entry, is current practice. Active real-time problem diagnosis, data organization, symptom/problem/resolution data base access, and resolution identification has been enabled at various levels by the use of laptop applications.

Activity within the market to deliver mobile communications capabilities includes the development of third-party mobile communications network operators. RAM Mobile Data Network utilizes a fully digital packet-switched network coupled with FM cellular technology, enabling field personnel to exchange information with a dispatch or technical center, retrieve data from or submit data to data bases, communicate with other field engineers, or collect and send E-mail.

EXHIBIT IV-6

State of the Practice in Field Communications Technology

Technology	Characteristics	Advantages
On-line field communications (With on-board processors)	• Portable FM or cellular data terminals providing continuous communications capability	• On-line call assignment and close-out • Parts request • Test data access
Laptop/portable computers	• May be enabled with embedded diagnostics technologies • May be linked to central system as active node • Higher capacity for CIF/DB input	• In-depth diagnostics/evaluation • Comprehensive CIF/DB interface and data organization
Portable multimedium information retrieval/storage units	• High capacity storage/ retrieval system employing image/video display with enhanced person/machine interface	• Provides "encyclopedia" diagnostics capability with backward/forward chained search and retrieval

RAM Mobile and Ericsson GE Mobile Data Inc. have both reached agreements with Sears Business Centers (SBC). SBC will be the systems integrator for RAM's radio-based mobile data network. In a separate agreement, SBC will market Ericsson GE mobile data products. SBC will provide system design, integration, mobile data products, training, and support for turnkey mobile data communications systems.

Pitney Bowes (PB) has contracted with the ARDIS (Motorola) data radio network to support 3,200 PB service representatives in 720 locations nationwide. The application allows PB customer service people to query the "Acess" on-line remote service system. Acess is a computerized dispatch and work management system that provides on-line service history and real-time parts availability. Before adding the ARDIS radio net, PB service representatives had to call one of 16 Acess centers to receive and close out service calls. Pagers were used in some areas, however service reps were still required to stop whatever they were doing and find a phone. ARDIS operates a nationwide radio data information service, covering 8,000 cities and towns in all 50 states.

4. Help Desk/Technical Assistance Center

Over the past five years the ability and the requirement throughout the industry, within both the user and vendor communities, to provide telephone support to the information systems end user has been firmly established.

The changing characteristics of service problems—the growing proportions in software- and systems/network control-related downtime compared to hardware-related maintenance and repair—has required the installation of a formal function to competently handle the administration of these problems. The requirement of the vendor to deliver a "fix" on a timely basis, regardless of the nature of the problem (software- or hardware-related), is still and will remain a high priority.

In an effort to differentiate the terms, service vendors have developed Technical Assistance Centers that in practice provide a centralized point of initial call management and analysis of all hardware and "soft" service situations. This operation cannot be cleanly separated in a field service organization from the more traditional call handling and dispatch functions.

Large information systems users have also developed in-house "help desks" to assist the system's end users in troubleshooting and problem resolution. Staffing may often include factory service engineers and/or in-house technical personnel supplied with relevant documentation and whatever diagnostic tools are available.

Exhibit IV-7 presents examples of help desk applications as described by The Help Desk Institute, Colorado Springs, CO. The institute explained that there is no set definition for help desk applications, but the composition of the available software concentrates' on the logging and tracking of maintenance and service events in an organization's overall network environment. The primary assumption in defining the help desk function is its dedication to a single network environment.

EXHIBIT IV-7

Examples of Help Desk Applications

- Configuration management
  - Communication/path tracking
  - System (pre-)change management
- Help Desk support software
  - On-line trouble management, tracking, and resolution
  - Problem encyclopedia with definable follow-up
- Advanced methods Help Desk software
  - Help Desk expert automation tool
  - Help Desk shell: call navigation, data base, and interface support (hypermedia) Help Desk software; with experience-based resolution search methods—pre-emptive support

Source: Help Desk Institute

5. Other Contributing Technologies

Caller/telephone number identification can enable the CIF/DB to be accessed prior to initial voice contact with the end user. This capability can provide call reception personnel with full information concerning the caller's installed base, contract terms, and credit status.

Significantly, this technology can enable the receptionist to provide an extremely personal touch to the initial service request process. A lead-in of "Hello Mr. Smith, how can we help you today?" may be disconcerting at first, but may ultimately provide the end user with a greater comfort level.

Digitized mapping has been implemented in several applications as a graphics-based system interface for the call handling and dispatch function.

GTE Information Services developed an extremely sophisticated call handling and dispatch application based on comprehensive operations research that schedules, tracks, and coordinates service calls by computing the best possible sequence of calls on the basis of productivity and cost benefits. This system then displays these optimized routes on a map of the

appropriate service area, identifying and color coding each service call based on repair and response time priority. The dispatch plan would be updated by the system each time a variable concerning a new or scheduled service call changes.

CD ROM has been seen as a possible technology for providing encyclopedic maintenance and repair information to TAC and field personnel. Portable CD transport devices—such as commercial CD players— may have far-reaching benefits in allowing FEs to have local access to vast quantities of repair and diagnostics information. Multimedia presentation and interface with this type of CD ROM technology is ideally suited for educational purposes, but as yet is purely developmental as a tool for the field operation.

D

Benefits of FSIS/Technology Implementation

Benefits appear in two ways when implementing the technologies discussed here.

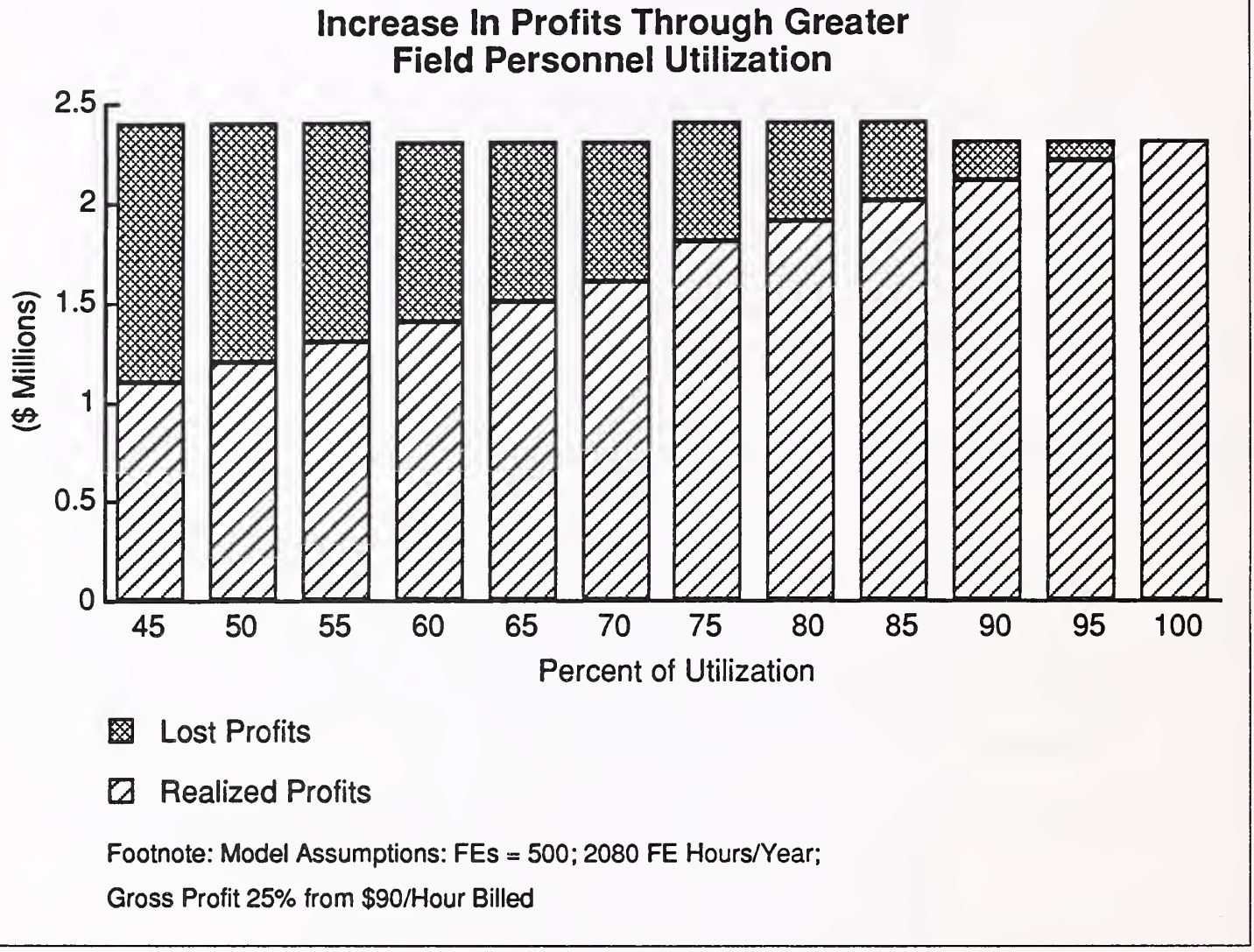
- First, there is refinement of the real-time service operation—using and distributing information in a way that produces value—in shorter response times, in more accurate diagnosis, and in communicating customer needs in a more precise way.

- Second, they provide a means of capturing information and data regarding service call histories, product reliability, maintainability, MTTR, MTBF, and organization operating parameters—all of which can be used in the formal service organization.

Exhibit IV-8 examines the first benefit concept by illustrating profitability changes associated with a greater degree of field personnel utilization. Previous studies assessing the service industry have estimated that, on average, a field service organization operates at a 55% utilization rate—that is, the average service operation is able to bill only 55% of the available FE hours.

Assuming a field labor force of 500 FEs each having an availability of 2,080 hours per year billed at $90 per hour, and assuming a gross profit margin of 25% or $22.50 per hour, it can be estimated that the total annual profit available for this hypothetical organization, operating at 100% utilization, is $23,400,000.

EXHIBIT IV-8



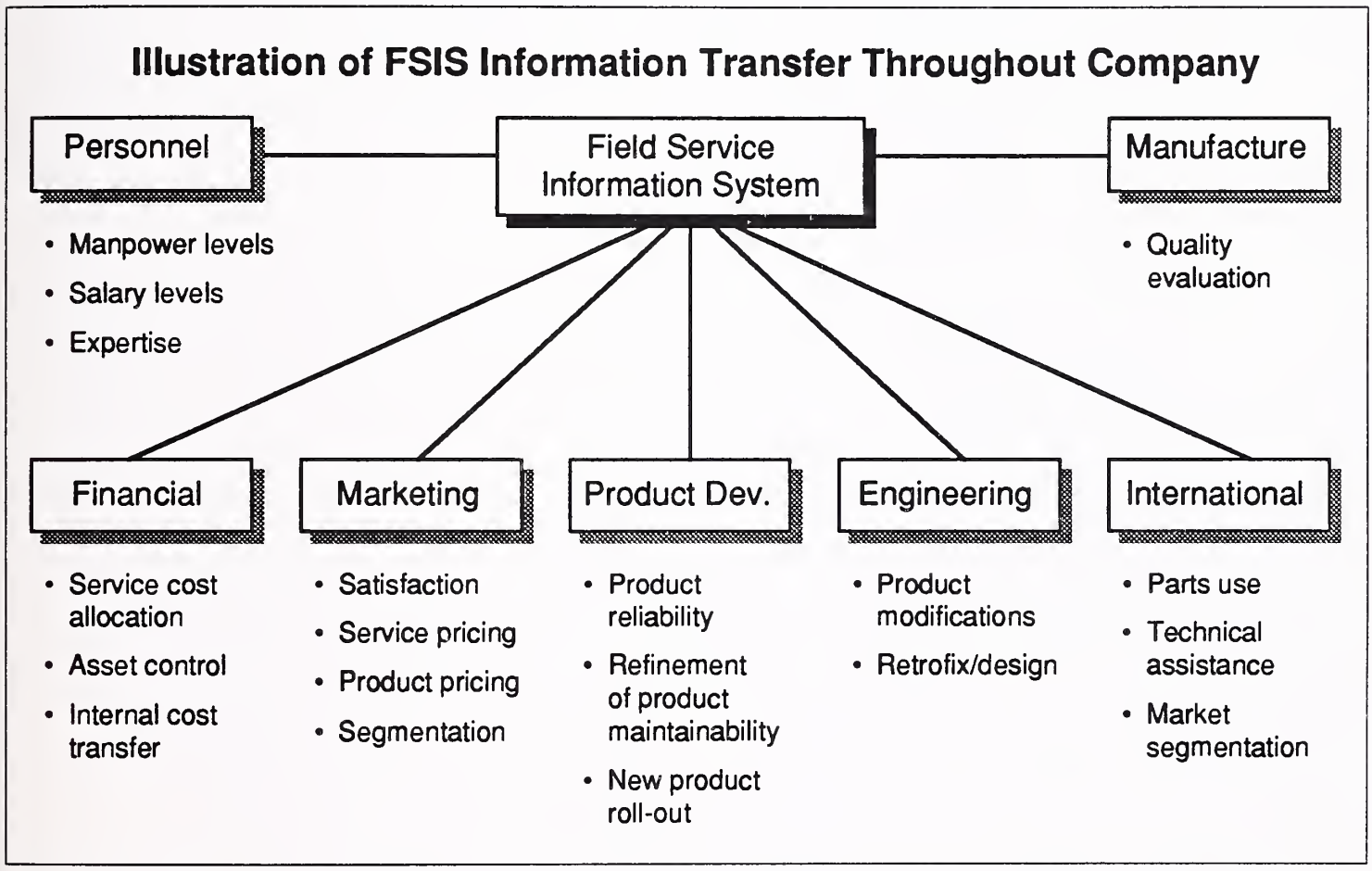
The organization operating at 55% utilization, assuming the same operating characteristics realizes only $12,870,000 of the $23.4 million in available profits. Although 100% utilization is an unrealistic goal, an increase of 5% in the utilization rate can produce significant results; using the same assumptions, an increase to 60% would improve the realized profits by $1,170,000 to a total of $14,040,000.

A primary contributor to the increase in field utilization is the competent use of diagnostic methods and call assignment procedures that investigate dispatch avoidance alternatives.

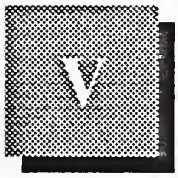
The thorough use of the raw data and information generated by the implementation of an FSIS and/or any of the automated functions that fall under the FSIS "umbrella" can produce value for many aspects of the extended service organization—marketing, competitive analysis, or cost/contribution analysis; and for the manufacturing organization, quality control, product design, and product development.

Exhibit IV-9 provides an example of where the information generated by the service operation can be assimilated into other functions. Competitively, ISOs have used the maintenance and repair information gained on OEM equipment to establish comprehensive information on the performance and maintenance characteristics of this equipment. In some instances this has enabled the ISO to establish a more accurate performance and failure profile of a given "box" than the OEM, who may rely too heavily on product design parameters.

EXHIBIT IV-9



Vendor/Competitive Assessment



Vendor/Competitive Assessment

A

Assessment of FSIS Implementation in the Overall Computer and Information Services Market

Recent industry studies have estimated that 20-25% of the field service organizations in the computer and information services industry have formally implemented FSIS applications supporting the functions described in Chapter IV.

FSIS usage is heavily skewed toward large service organizations having over 1,000 field engineers. Virtually 100% of these companies have developed or purchased integrated support systems for their service operations.

Exhibit V-1 shows midsized and smaller service organizations which, by number, comprise most of the vendor community have been slower in implementing integrated FSIS. Typically these companies automate various support activities but do not implement the data base and communications technologies required for competent information transfer. Often the advantages of these efforts are tainted by data duplication, inadequate data access, and the lack of reporting flexibility.

The FSIS market, defined as the revenues of the "standardized" FSIS applications vendors, is currently estimated by industry analysts at approximately $1 billion and is anticipated to grow at well above 10% annually. The market for custom and in-house FSIS applications is difficult to estimate, but is expected to slow to a maintenance level due to market saturation in large service organizations and the increasing acceptance and price/performance of packaged FSIS applications in the remainder of the vendor community.

EXHIBIT V-1

Estimated Distribution of FSIS in Computer and Information Technology Companies

Size of Service Org. (No. of Field Engineers)	Distribution (Percent)	Total Number Field Org.	Estimated FSIS Technology Use	Estimated Number Org. Using FSIS	FSIS/Technology Users Distribution (Percent)
5-19	34	1,200	5	60	7
20-49	26	900	10	90	11
50-99	15	500	30	150	19
100-499	12	400	40	160	20
500-999	12	400	75	300	37
1,000-4,999	1	40	100	40	5
5,000 or more	0	10	100	10	1
Est. Total	100	3,450	N/A	810	100

There is a significant lag in the implementation of advanced technologies in the overall computer and information services market. The same "vanguard" of OEM and large ISO service organizations is active in developing operational diagnostic and AI applications to enhance service capability. Outside of this vanguard the economies of scale do not allow the investment necessary to implement such programs.

The activity of strategic partnering muddies this assessment in that many OEM companies provide partners with access and/or licensing to utilize diagnostic programs and response centers. Partnerships that include spares allocations can also allow the down-line partner to gain the benefits of donating to an organization's inventory and logistics controls procedures and programs.

The true value-adding characteristics of a single-service organization having full operational knowledge are not transferable; any benefits received by partners are controllable and typically limited to precise repair-related information.

Overall, and in much the same way as witnessed in the computer products industry, state-of-the-art FSIS technologies are not readily accessible to, or affordable by, the great majority of the user marketplace.

The possible exception to this is the growing access to mobile communications technologies. The availability of third-party mobile network operators enables the service organization to implement any level of information transfer to field personnel without the costs of independently developing a network infrastructure.

Exhibit V-2 provides a summary of FSIS and advanced technology implementation activity suggested by the above observations.

EXHIBIT V-2A

Summary of FSIS/Support Technology Utilization

Support Technology	ISO/IMO/TPM	OEM	Comments
FSIS - Umbrella • Call handling & dispatch • Logistics & inventory • Service billing/financial • Customer info. file/data base DBMS - Integration of FSIS data/information structure	• Utilization estimated tobe approx. 12% to 20%	• Utilization estimated to be approx. 25% to 30% • Capacity for creating added value due to FSIS information looped back into product engineering and manufacturing processes	• Major ISOs (Intelogic Trace, Decision Data, Control Data, BABS—which comprise over 45% of the ISO/TPM market) have well-established FSIS and functional integration. Remainder of ISO segment is inconsistent in FSIS implementation development and integration. • Typically, CHAD is the primary channel for automation and overall FSIS development. • CIF/DB is built, reactively, from existing data points. Proactive or "by design" data retrieval and allocation and data base performance issues represent current development areas. • Packaged FSIS applications represent industry benchmark. However, OEM use and development of advanced technology applications will remain as state of the art.

EXHIBIT V-2B

Summary of FSIS/Support Technology Utilization

Support Technology	ISO/IMO/TPM	OEM	Comments
Remote access/remote diagnostics	• Proprietary diagnostic software available through licensing and strategic partnering • Developed through reverse engineering efforts	• OEM has significant advantage via "by design" development of embedded diagnostic programs and proprietary access/fault isolation	• Embedded diagnostics with remote access establishes proactive posture by enabling the capability for real-time fault indication • The strong market movement toward software and system/network control services reinforces the importance of real-time remote diagnostics, access, and repair methods and applications
Artificial intelligence	• Vanguard technology within both ISO and OEM segments		• Active as conceptual technology; however, actual implementation has been characterized by narrowly-defined applications • State of the art in AI development sees more general applications in self-organizing, intelligent data base, data linkage, and interface methodologies • Available AI "shells" provide access to development architectures
Mobile data communications	• Third-party mobile data network operators enable cost-efficient implementation options. (RAM, ARDIS (Motorola))		• Data transfer between FE and dispatch center (TAC), whether real-time or selective up/down load, can significantly contribute to increased field labor utilization rates by reducing FE unbillable "downtime" • State of the art focuses on portable computing technology to enable levels of decentralized data manipulation, storage, and retrieval, giving more of the problem-solving power and responsibility to the on-site FE • Mobile systems integration vendors (Motorola, Sears Business Systems, Ericcson) facilitate mobile configuration design and maintenance

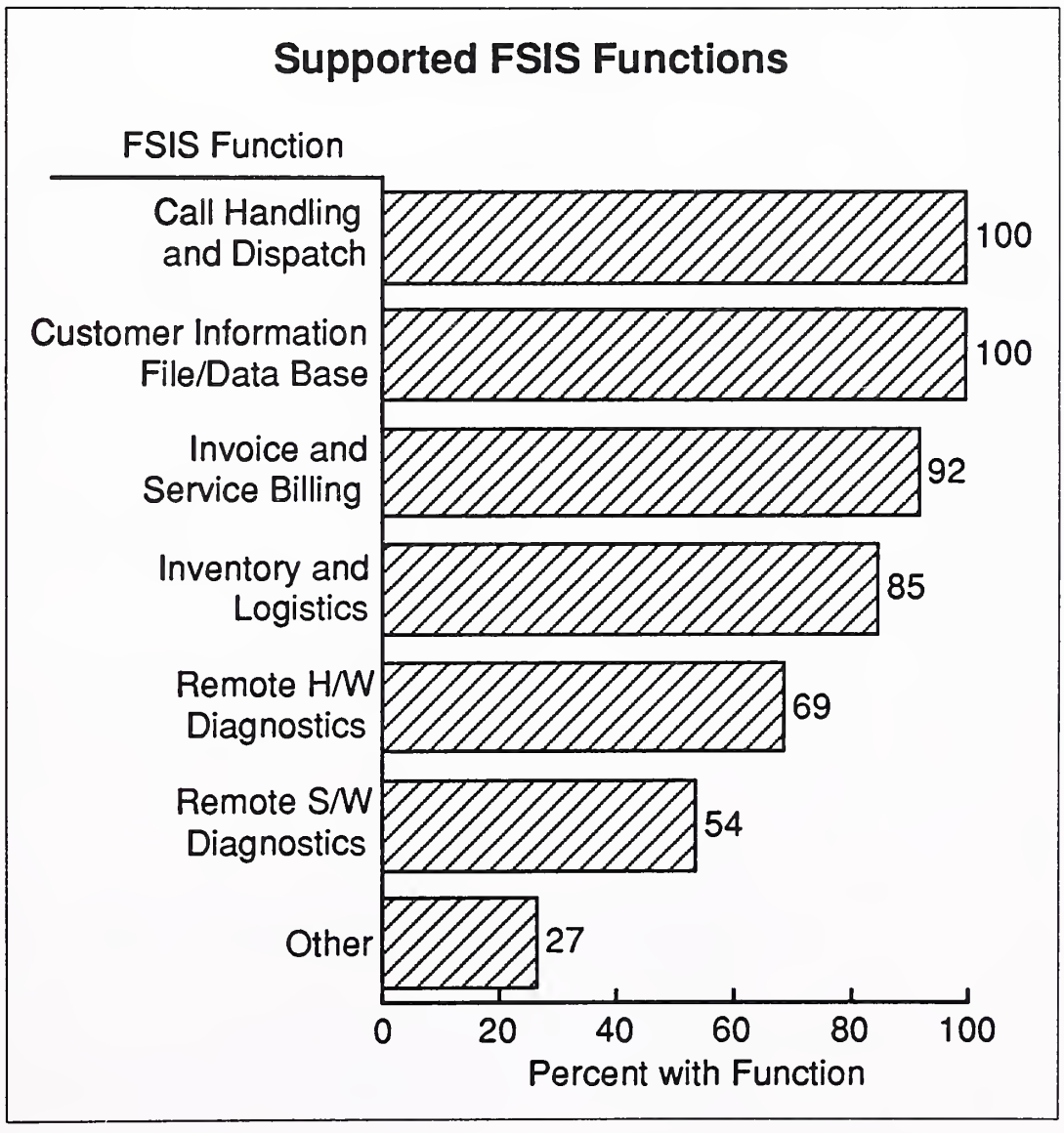
B

Vendor Survey Results

All of the vendors surveyed indicate that they have implemented a Field Service Information System (FSIS) and currently operate this system in their day-to-day service operation. This generally supports the market model in section A, as the mean number of field engineers in the vendor sample was 703.

Exhibit V-3 shows that the FSISs utilized support the major functions discussed in Chapter III. Some vendors indicated that specific functions such as billing and logistics are supported by separate systems that interface with the FSIS. Such systematic differences should not detract from the fact that these functions are indeed part of the information transferred within the service organization.

EXHIBIT V-3

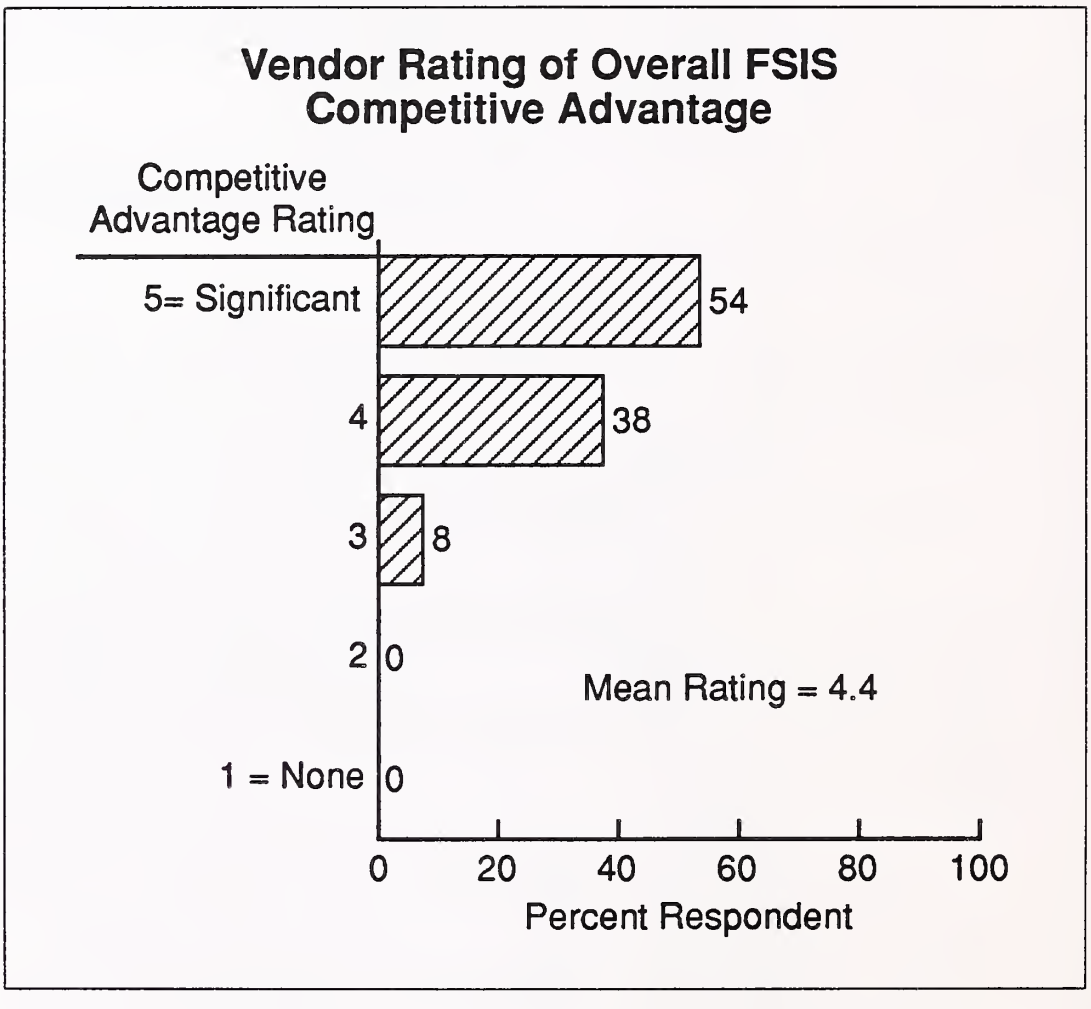


Virtually all of the vendors in this sample have custom-developed FSIS systems. One company built customized function modules around a standardized dispatch module.

Additional functions implemented by vendors, such as customer satisfaction status reports, are directly related to the abilities of the CIF/DB function and the report-generating capability of the overall FSIS.

All vendors indicated that utilization of an FSIS provided them with a strong competitive advantage. Exhibit V-4 displays how the vendors rated this factor. Significantly, the sample mean for this response was a very high score—4.4 on a scale of 1 to 5.

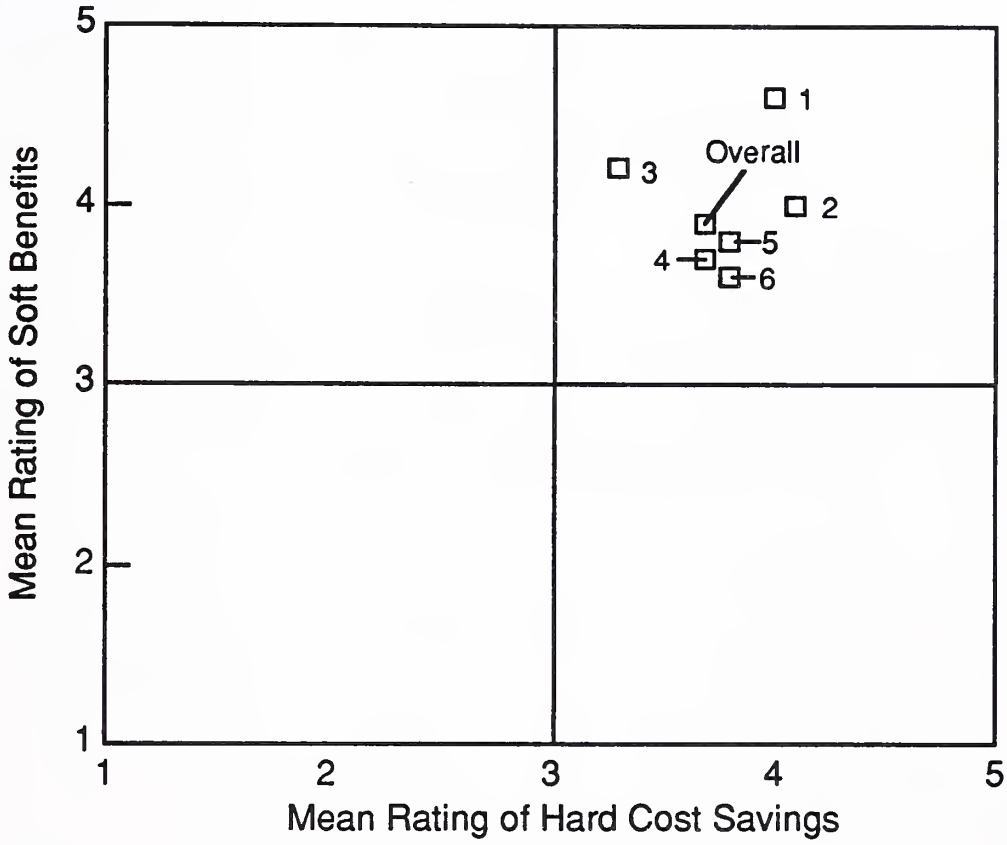
EXHIBIT V-4



When asked to rate the hard cost savings and/or the "soft dollar" benefits provided by the major FSIS functions, it became evident, as shown in Exhibit V-5, that the overall FSIS concept was well received. All of the functions were rated well within the positive ratings. The ability of an FSIS to systematically refine the service delivery infrastructure and provide for better resource allocation is supported by the grouped ratings seen here.

EXHIBIT V-5

Perceived Levels of Hard/Soft Benefits of FSIS Implementation by Major Function



Legend ID	FSIS Function	Mean Rating Hard Cost Savings	Mean Rating Soft Benefits
1	Call Handling & Dispatch	4.0	4.6
2	Inventory & Logistics	4.1	4.0
3	CIF/Data Base	3.3	4.2
4	Invoice & Service Billing	3.7	3.7
5	Remote H/W Diagnostics	3.8	3.8
6	Remote S/W Diagnostics	3.8	3.6
	Overall Rating of FSIS	3.7	3.9

Rating based on 1-5 scale;
1 = No Savings/Benefits, 5 = Significant Savings/Benefits

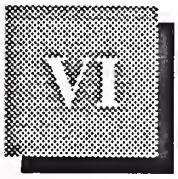
The rating scores suggest that vendors credit the call handling and dispatch function with the greatest ability to reduce costs as well as provide significant soft dollar benefits. This supports the assumption that it is the call handling function that, accessing the information organized within the CIF/DB and enabling the evaluation of the USR, determines and controls the allocation of field and other down-line resources.

The ratings given to inventory and data base functions, respectively, reflect the responsibility of those functions. Inventory methodologies built around actual usage patterns can reduce static inventories by as much as 25%; this translates into significant cost reductions.

The CIF/DB function provides value by enabling the coherent transfer of information throughout the service operation. Ideally, by the organization and manipulation of data the CIF/DB supports the decision-making process though the entire service transaction. The value of an informed decision is difficult to quantify.

Return on investment for FSIS systems and related operational adjustments should be achievable within one to two years, although this is very elastic. Companies with large field organizations should have a shorter ROI period. Economies of scale associated with inventory, logistics and field personnel will be reflected in the cost reductions and operational improvement brought about by the FSIS.

Conclusions and Recommendations



Conclusions and Recommendations

A
Summary Conclusions

There is a vanguard of larger manufacturer-owned service organizations and ISOs in which the utilization of a FSIS appears to be an operational prerequirement and is a "me too" technology. True competitive advantage will be seen in how the information pulled from these systems is used to add value in the organization.

The implementation of advanced support technologies will occur within this vanguard as the players push to gain market share and/or boost profitability in a market characterized by escalating user demands.

The technologies under the FSIS umbrella have been implemented and designed to refine and optimize the day-to-day operation of the field service organization. The study results indicate that "traditional" services, focusing on maintenance and repair tasks, still represent the majority (approximately 85%-90%) of revenues for service organizations. There is evidence in the existence of new start-ups and changing organizational structures that this predominance of "traditional" services in generating revenues and profits will slowly erode.

As the product mixture of the service organization evolves to include more professional and ancillary services, new functions will need to be considered to deal with the economics and project-oriented nature of these activities.

Implementation of FSISs in smaller service companies (under 500 FEs) focuses on the coherent integration of departmental/functional support systems. Advanced technology implementation will be slow until there is a reduction in the cost of these applications. Currently, smaller companies do not have the volume of service activity needed to ensure timely ROI.

The advantages to implementing the technologies discussed in this report are many—both hard cost saving and value-adding benefits can be achieved with the prudent implementation of these technologies within the auspices of the FSIS concept. To balance the debate we must identify the disadvantages of implementing these mechanisms:

- Significant investment
- Increased dependence on these technologies for service call resolution, reducing the reliance on experienced human field engineers. User perceptions of "personal" service may be negatively affected.
- Capacity for "cookbook" mentality in service delivery, contributing to limited understanding of underlying system characteristics

B
Recommendations

Each decision in the design and configuration of an FSIS and the assimilation of any advanced technologies into the FSIS umbrella will necessitate some trade-offs. The "nuts and bolts" development and implementation of these technologies into the workings of the service operation can be competently assessed only on a case-by-case basis.

Specific recommendations of which technology will produce significant results in any given service organization is impossible and imprudent.

In considering new support technologies, the implementation of an FSIS must be done with the knowledge that the system will impact the way the organization does business on an operational level.

- The challenge is to implement the technologies and to maintain operations and practices that have consistently worked for the service organization.
- Conversely, companies should be prepared to change the operational characteristics of their service organizations when it is recognized that new, usable information is retrievable through the FSIS and can be leveraged into additional service products and/or value-adding procedures.

There are many operational factors that can be used as a "litmus test" of how FSIS technologies may impact a company's service delivery infrastructure. Though this assessment cannot directly provide hard numbers to support an implementation decision, when taken on the aggregate these characteristics may indicate an advantage to the service organization through FSIS and advanced technology implementation.

The number of FEs can be used with other variables to provide many measures of overall service performance. Through the application of FSISs and related advanced technologies in a strategic methodology, many of these characteristic measures can be improved. An example of measures or ratios associated with the number of FEs includes, but is certainly not limited to:

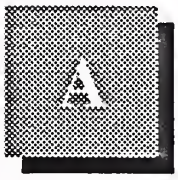
- Number FEs/Number Customer Sites
- Number FEs/On-Site Calls (Day/Week/Month)
- Number FEs/Revenues
- Number FEs/Skill Levels
- Number FEs/Other Personnel

Other variables, like those outlined in the Appendix B matrixes, can be used to produce a rudimentary performance model for a service operation. Done manually, this process can highlight where and how FSIS technologies will have a significant impact. Even with FSIS components in operation, this type of "what if" analysis can be useful in assessing the contribution of new/advanced technology applications and in helping companies develop an intuitive model of how their specific organizations are performing against forecast and competitive goals.

The most important concept to understand regarding support technologies is that these concepts produce *control* of the service function. Control enables the competent adjustment of operating variables to optimize profits *and* optimize customer/end-user satisfaction.

It is recommended that service managers use the information presented in this report, supported by their own company's operating data, to refine operating estimates, perform analysis of functional interrelationships, and identify performance gaps or inconsistencies that may be eliminated by FSIS automation and the implementation of new support technologies.

Appendixes

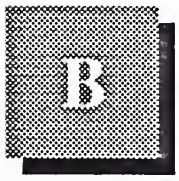


Glossary of Acronyms

FSIS* -	Field Service Information System
FSMS* -	Field Service Management System
FSMIS* -	Field Service Management Information System
TAC -	Technical Assistance Center
MTBF -	Mean Time Between Failure
MTTR -	Mean Time To Repair
IMO** -	Independent Maintenance Organization
ISO** -	Independent Service Organization
TPM** -	Third-Party Maintenance Organization
USR -	User (s) Service Request
FRU -	Field Replaceable Unit
SKU -	Stock Keeping Unit
FE -	Field Engineer
DBMS -	Data Base Management System (Subsystem)
CIF -	Customer Information File
CIF/DB -	Customer Information File/Data Base
AI -	Artificial Intelligence
SUT -	System Under Test

* Interchangeable

** Interchangeable



FSIS Functional Requirement by General Support Category

EXHIBIT B-1A

FSIS Functional Requirements by General Support Category

Support Component	Example of Line-Item Functions
Call handling and dispatch • Call opening/reception • Call assignment • Call escalation • Call closure (TAC and Dispatch Avoidance Inclusive)	Call opening • Time and date stamp • Identify customer • Identify customer credit status • Identify location • Identify installed base of equipment at location • Identify contract status • Enter service priority • Assign call to queue • Enable dispatch avoidance routines—route to TAC • Assign USR number • Place USR on hold: - Credit - Parts/materials • Test for call duplicity Assign call • Availability of FE • Test for FE skill level/type of skill required • Ability to assign FE team/multiple FEs • View/transfer call information, assignment, and escalation information to FE • Enable transmission of information to FE via telephone, pager, data terminal, laptop • Record and track FE ETA Technical assistance • Monitor, queue, and track technical USR to include: - customer - product/identification number - symptom(s) - fault ID - solution, actions taken • Elapsed time for "fix" • Alert "flag" for calls open/unresolved outside defined parameters • Product/problem/solution histories • Customer hardware/software/configuration information • Diagnostic call screening; route to formal diagnostic query • On-line technical assistance for regional offices and/or customer-basedTAC and/or FE with mobile comm. ability

EXHIBIT B-1B

FSIS Functional Requirements by General Support Category

Support Component	Example of Line-Item Functions
Call handling and dispatch • Call opening/reception • Call assignment • Call escalation • Call closure (TAC and Dispatch Avoidance Inclusive)	Escalation • Automatic update of queue • Ability for manual override of queue logic • Automatic "alert" conditions and "flag" criteria • Priority escalation Call Closure • Assess and Post: - Labor charges - Materials and consumables used - Travel and expenses - Receive problem code - Equipment code - Receive FE commentary (image processing application) - Manage subcontractor/partnership files - Process escalation and priority patterns

EXHIBIT B-1C

FSIS Functional Requirements by General Support Category

Support Component	Example of Line-Item Functions
Preventive Maintenance; Project Planning, Management of Professional and Ancillary Services	Project-oriented scheduling; P.M. • Task scheduling to end of term/contract • Equipment/task profiles • Resources/technical personnel/materials required • Manpower scheduling • Assignment/priority notice • Parts identification and scheduling • Interface with sales, professional services information • Optimize future schedules based on manpower • Parts and tools availability, location, etc. • Create/print project schedules: - Unlimited task events - Critical path scheduling - Resource conflicts - Daily, weekly, monthly schedules; call and task synopsis

EXHIBIT B-1D

FSIS Functional Requirements by General Support Category

Support Component	Example of Line-Item Functions
Logistics and Inventory Control • Order Entry Processing • Order Status/Query • Backorder Management • Inventory Movement • Forecasting • Distributor/Partner Management • Parts Master File/DB	Order Entry Processing • Order confirmation with ship date • Generation of pick/pack list • Generation of shipping manifest • Remote on-line entry • Multiple "ship to" addresses • Backorder status • Substitution procedures • Authorized buyer ID • Order payment authorization • Accept and process internally generated orders for warranty exchange parts • Establish and maintain order priority • Issue return material credit authorization • Price control based on customer/product/price matrix • Multiple discount parameters • Total invoice discount • Accept order for non-standard parts • Automatic minimum order charge • Automated allocation against - Inventory - Purchase orders - Open USR (service ticket) - Inventory changes • Pending product/part conversion status • Automatic least cost routing of order to nearest inventory/ stock location • Performance reporting on fill rate, volumes, etc Order Status/Query • Capability to change order status prior to shipment • Shipment verification • Reporting of sales orders by customer, product/part number Backorder Management • Daily listing of part numbers on backorder • Automatic allocation against - New purchase orders - New USR

EXHIBIT B-1E

FSIS Functional Requirements by General Support Category

Support Component	Example of Line-Item Functions
Logistics and Inventory Control • Order Entry Processing • Order Status/Query • Backorder Management • Inventory Movement • Forecasting • Distributor/Partner Management • Parts Master File/DB	Inventory Movement • Bar code scanning • Audit trail of an inventory movement, including in-transit status • Inventory adjustments identified by location, to the most local level • Maintain standard inventory parameters; location on-hand, allocated, item value, total value, backorder, open purchase order, kits composition • Good/defective inventory • Excess/obsolete reporting • End of part/product life status • Analysis/ reporting of inventory investment by product against sales Forecasting • Reorder/forecast quantity based on order entry demand • Ability to exclude large one-time demand • New model parts forecasting based on projected MTBF • Historical scrappage data by item • Forecast periods based upon weighted trending data Distributor/Partner Management • Identify distributor/partner and authorized products and services • Track license status • Monitor sales and performance • Administer preferred distributor/partner pricing discounts • Monitor distributor/partner training • Receive/assimilate product service histories • Interface and monitor distribution/partners order cycles • Automatic support for product/service referrals to distributor/partner by zip code/service zone • Performance quality tracking - End-user complaints and actions taken - Support referral follow-up/customer satisfaction assessment/comments • Tracking of supplies, equipment, etc. on loan • Analysis of distributor/partner against warranty claims Parts Master File/Data base • Part number/ SKU designation • Part definition • Source vendor/supplier • Cost • Field replaceable unit (FRU) attribution • Next higher/lower assembly/component • Parts listing by model/type • Substitution status - Old parts to new - New to old (substitute)

EXHIBIT B-1F

FSIS Functional Requirements by General Support Category

Support Component	Example of Line-Item Functions
Financial and Service Billing • Purchasing • Accounting • Financial Controls • Contract Management	Purchasing • Automatic purchase order generation • Display/access parts requisition with source • Track source(s) - Open purchase orders - Current backlog status per source - Established and forecast ship dates • Source performance measurements - Incoming inspection status - Performance against source contract terms • Purchase order reporting by source and model/part • Electronic interface with primary sources Accounting • Accounts receivable • General ledger • Sales orders • Purchasing support • Project budgeting/controls • Adaptability to international accounting Financial Controls • Invoicing • Credit check and hold • Warranty support/control • Audit trails • Project costs/ bundling capability • Forecast/budget/actual tracking • Collection status • Calculated cost charges to users • Fleet management support Contract Management • Single/multiple contract support per user • Multiple contract types/coverage/parameters • Bundle/unbundle specific contract item(s) • Multiple billed to options • Support multiple billing cycles • Assimilate - Response times - Travel rates - Equipment/repair type cost variations - Geographic/service zone cost variations

EXHIBIT B-1G

FSIS Functional Requirements by General Support Category

Support Component	Example of Line-Item Functions
Financial and Service Billing • Purchasing • Accounting • Financial Controls • Contract Management	Contract Management (continued) • Variable pricing - Strategic partner parameters - Full service contract - T & M contract - Software support only - Technical support • Discount administration - Discount/surcharges to overall contract - Discount/surcharges on individual line items - Discount/surcharges based on billing frequency - Discount/surcharges based on deferred response - Discount/surcharges based on volume • Contract renewal reporting (Flag Display) • Equipment under contract; detail information - Product brand/model/serial number - Warranty expiration date - Location/site • Prorated billing ability • Contract amendment records/administration • International capabilities - Language/monetary unit transposition

EXHIBIT B-1H

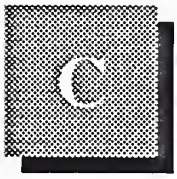
FSIS Functional Requirements by General Support Category

Support Component	Example of Line-Item Functions
MIS Requirements • Issues/Requirements • Representative CIF/DB File Categories • Reporting	Issues/Requirements • System documentation - For end user - For programmer - For System administrator • Down/upload capability - Branch to headquarter - HQ/branch to FE • Comprehensive training • Multilevel security/access controls • Detailed system transaction log • Integratability with other data base formats • On-line user help facilities • Screen windowing • Modifiable screen formats/parameters • Microcode available/documented • 4GL programming • Report writer • Batch processing options • Portability • Support of open architectures (UNIX) • Remote entry capabilities Representative CIF/DB File Categories • Customer DB • Equipment DB • Parts/Stock DB • Personnel DB • Fleet DB • Contract DB • Symptom/Problem/Repair DB Reporting • Revenue and expense - By FE - By region/zone - By customer/end user - By product/model line • Cost distribution • Profit contribution analysis • Contract status - Materials cost - Labor cost by classification - Expenses - Overhead assessment

EXHIBIT B-11

FSIS Functional Requirements by General Support Category

Support Component	Example of Line-Item Functions
MIS Requirements • Issues/Requirements • Representative CIF/DB File Categories • Reporting	Reporting • Contract status - Profitability by contract - Contract renewal reports • Performance reports - MTBF - MTTR - By FE - By equipment class - By customer/end-user - Call escalation status · By FE · By branch/zone • Ratio analysis - Calls/FE - Revenue/FE - Revenue/contract - FE/total employees - FE/technical assistance employees - Calls/required on-site visits - Available/billed FE hours - Costs/service visit (costs/service event)



User Questionnaire

The following two questionnaires have been used by INPUT during 1991 to conduct research in the customer support and services area. The findings from these interviews form much of the underlying research for this report.

INTRODUCTION; **END-USER** QUESTIONNAIRE

(ASK FOR SPECIFIC CONTACT IF AVAILABLE FROM SAMPLE. IF NONE EXISTS, ASK TO BE CONNECTED WITH THE PERSON RESPONSIBLE FOR THE ACQUISITION OF MAINTENANCE, REPAIR, AND SUPPORT SERVICES FOR THEIR COMPANY'S INSTALLED BASE OF COMPUTER AND ELECTRONIC SYSTEMS AND EQUIPMENT, INCLUDING NETWORKS.)

(INTRODUCTION TO OPERATOR); (IF NECESSARY):

Good morning/afternoon/evening. I'm Mr/Ms _____ calling long distance from INPUT in _____, and we are conducting a study about the support services available for computer and electronic systems and equipment, including networks.

(WHEN MANAGER COMES TO PHONE: INTRODUCTION TO MANAGER/EQUIPMENT SERVICE MANAGER)

Good morning/afternoon/evening. I'm Mr/Ms _____ calling from INPUT in _____. We are conducting a study to assess overall service quality with regard to computer and information-processing equipment and systems.

A. Just to check, do you have computer and information processing equipment operating or otherwise installed at this location?

[ ] Yes (CONTINUE)
[ ] No (THANK RESPONDENT AND TERMINATE)

B. Do you have managerial responsibility for the ongoing operation and support of these systems and equipment at your company?

[ ] Yes (GO TO INTRODUCTION)
[ ] No (CONTINUE)

C. May I please speak with that person? (OBTAIN NAME/TITLE/DEPARTMENT AND ASK TO BE CONNECTED)

(NOTE: BEFORE CONTINUING TO MAIN QUESTIONNAIRE, RESPONDENT MUST ANSWER "YES" TO QUESTIONS A AND B)

(INTRODUCTION)

As part of INPUT's continuing research programs, we are conducting a survey of end-users to assess their service needs and requirements and investigate the sensitivity to developing service issues. Your response will ultimately lead to better support options in the future. We would be happy to supply you with a summary of our findings from the subsequent report.

Would you have a few minutes at this time, or would you prefer I call back at a more convenient time?

[ ] IF AVAILABLE, CONTINUE WITH MAIN QUESTIONNAIRE, Q.6

[ ] IF NOT AVAILABLE, ARRANGE FOR CALLBACK

Callback Date: _____

Specific Time: _____AM/_____PM

MAIN **END-USER** QUESTIONNAIRE

I. BACKGROUND (TO BE VERIFIED AND RECORDED AS INTRODUCTION IS CONDUCTED)

A. Known Systems/Equipment:

_____ _____

_____ _____

_____ _____

B. Title of Respondent: (DO NOT READ LIST)

[ ] MIS Director
[ ] Director Data Center Operations
[ ] Director of Purchasing
[ ] Other (Specify: _____)

(REMAINDER TO BE CONDUCTED AS QUESTIONS TO BE READ VERBATIM)

II. CURRENT SERVICE/SUPPORT STATUS

1. For each of the following types of equipment that I list, please indicate approximately how many units are under your charge—that is, where you are responsible for the administration or management of service for that equipment.

2. For the equipment categories you mentioned, do you service any of this equipment in-house? If so, exactly what kinds of service do you provide for this equipment?

TYPE OF EQUIPMENT	NUM. OF UNITS	IN-HOUSE SERVICE		KIND OF SERVICE DONE BY IN-HOUSE PERSONNEL
DATA PROCESSING:		Y	N	
- Mainframe (MIPS/UNITS)	#_____	1	2	_____
- Minicomputers (MIPS/Unit)	#_____	1	2	_____
- Workstations (H.End PCs)	#_____	1	2	_____
- PCs	#_____	1	2	_____
- CRTs/Data Terminals	#_____	1	2	_____
NETWORKS:				
- Terminal Networks (Nodes)	#_____	1	2	_____
- LANs (# Nodes)	#_____	1	2	_____
PERIPHERALS:				
- Printers, other periphs,	#_____	1	2	_____
- Disk Drives (GigaBytes)	#_____	1	2	_____
OFFICE AUTOMATION:				
- Copiers	#_____	1	2	_____
- FAX machines	#_____	1	2	_____
OTHER:				
_____	#_____	1	2	_____
_____	#_____	1	2	_____
_____	#_____	1	2	_____

3. What is the name of your **primary** external service supplier?

   Primary Vendor: _____

4. How many external service suppliers do you currently have providing service and support for your installed base of equipment?

   Number of External Service Vendors # _____

5. Which of the following service features do you have provided to you for those types of equipment you have mentioned. (RECORD BELOW; READ THROUGH ENTIRE LIST)

6. Please rate the importance of each service feature provided to you on a scale from 1 to 5, where 1 = NOT IMPORTANT and a 5 = EXTREMELY IMPORTANT. (READ BACK LIST OF SERVICE FEATURES THAT ARE BEING PROVIDED TO RESPONDENT. RECORD BELOW)

SERVICE FEATURE	CURRENTLY HAS W/ SERVICE (Q.5)	RATING OF IMPORTANCE (Q.6)
Parts	1	_____
Labor	1	_____
Preventive Maintenance	1	_____
7-Day/24-Hour Service	1	_____
Guaranteed 4-hour response time	1	_____
Guaranteed 2-hour response time	1	_____
Guaranteed 1-hour response time	1	_____
Unlimited Service Calls	1	_____
Factory Depot Service	1	_____
Replacement/Loaner units	1	_____
Uptime Guarantee	1	_____
On-Site Service Engineer	1	_____
Telephone Support/Help Desk	1	_____
Installations/Moves/Adds	1	_____
Remote Hardware Diagnostics	1	_____
Micro-Code Diagnostics/Repair	1	_____
Other Software Diag./Repair	1	_____

IF YES TO DIAG. QUESTIONS:

7. In the delivery of the software/hardware diagnostics and repair services, do you have access to the service vendor's problem/resolution data base?

[ ] Yes [ ] No

8. Do you have the ability to upload or download problem or solution information to your service vendor?

[ ] Yes [ ] No

9. Do you currently receive any of the following discounts off your service pricing? (RECORD BELOW)

10. If you do not presently receive any discounts, what is your level of interest in the mentioned discounts? Rate 1 to 5, where 1 indicates LOW INTEREST, and 5 indicates HIGH INTEREST.

TYPE OF DISCOUNT	RECEIVES	L.O.I.
Multiyear Contract/Agreement	1	_____
Prepayment	1	_____
Call Screening/Problem Manag. Dispatch Avoidance Meth.	1	_____
Deferred Response	1	_____
Other: (Specify:_____)	1	_____

III. PERCEPTIONS ON EXPANDED/INNOVATIVE SERVICES

11. Do the external customer service vendors provide you with any of the following expanded services or product offerings? (READ THROUGH LIST; RECORD BELOW IN COLUMN A)

12. Of the expanded services provided to you by your service vendors, please rate (on scale from 1 to 5) how important this service is to your company. 1 indicates that the service category is of LOW IMPORTANCE, and 5 indicates that the service category is of EXTREME IMPORTANCE to your company.

13. Please rate the level of performance you receive from your service organization in delivering these expanded services. Again use a scale from 1 to 5, where 1 indicates NOT AT ALL SATISFIED with the service performance and 5 indicates that you are EXTREMELY SATISFIED with the performance of the service organization in delivering these expanded services to you.

EXPANDED SERVICE PRODUCTS	RECEIVES SRV.ITEM (Q.11)	RATE IMP. (1 TO 5) (Q.12)	PERF.RATE (1 TO 5 (Q.13)
PLANNING/DESIGN SERVICES:		_____	_____
- Design & Engineering	1		
- Site Planning	1		
- Purchase Consultation	1		
NETWORK SERVICES:		_____	_____
- Cabling	1		
- Network Maintenance	1		
- Network Management	1		
SOFTWARE AND SERVICES:		_____	_____
- Applications Training	1		
- Standardized Software Products	1		
- Custom Applications Development	1		
HUMAN RESOURCES:		_____	_____
- Recruitment/Staffing	1		
- Temporary Personnel	1		
DISASTER RECOVERY SERVICES:	1	_____	_____
SECURITY SERVICES:		_____	_____
- Network/System Security	1		
- Security Planning	1		

14. Approximately when did your service vendor begin offering these expanded or nontraditional services.

Date expanded services rec'vd ___/___/___

IV. ONE-STOP CUSTOMER/FIELD SERVICE AND SUPPORT

15. Some service vendors are now in the practice of contracting to supply a single point of contact for all of the end-user's service needs—tying systems software support, applications support, and related services with the more traditional aspects of multi-vendor hardware services. Are you presently participating in this type of service agreement?

[ ] Yes **(skip to Q.18)**

[ ] No

16. On a scale of 1 to 5, what would be your level of interest in this type of "single point of contact" service arrangement? 1 indicates NO INTEREST, and 5 indicates HIGH LEVEL OF INTEREST.

No Interest 1
2
3
4
High Interest 5

17. How much of a premium would you be willing to pay to have this "single point of contact"?

[ ] Would not pay premium
[ ] Uncertain
[ ] Willing to pay additonal 1-5%
[ ] Willing to pay additonal 6-10%
[ ] Willing to pay more than 10%

} **(skip to Q.20)**

18. When entering into this "single point of contact" service agreement, was your company required to submit any type of application to be eligible to receive this service?

[ ] Yes

[ ] No **(skip to Q.20)**

19. Which, if any, of the following information was required on this application?

[ ] Equipment Inventory: ("did this include")
- [ ] Number of Units
- [ ] Location(s) of all units
- [ ] Manufacturer
- [ ] Model Numbers
- [ ] Serial Numbers
- [ ] Current Warranty Status

[ ] Overall Service Expenditure Information
[ ] Availability of Equipment Service Records

20. Some service suppliers are in the practice of subcontracting certain services to third parties. Do you feel this:

[ ] Has a negative impact on service quality
[ ] Makes no difference
[ ] Has a positive impact on service quality

V. PERCEPTIONS REGARDING SERVICE MARKET AND DEMAND TRENDS

21. Many industry sources cite the advancement of computer and electronics technologies and their applications, especially the expanding use of networks, as creating an increased sensitivity by the end-user for service and support of this equipment. Compared to, say, two years ago; how much more sensitive are you toward service and support issues in general? Rate with 1 indicating LOW SENSITIVITY and 5 indicating HIGH SENSITIVITY.

Low Sensitivity	1 2 3 4	} **(skip to Q.23)**
High Sensitivity	5	

22. What issues are most important to you?

[ ] Response [ ] No Response

(Probe: network maintenance, response times, configuration design development)

_____

_____

_____

23. Do you consider the support needs of "Open Architectures/Systems" and/or UNIX systems as different from those of other systems?

[ ] Yes [ ] No **(skip to Q.25)**

24. Why?

[ ] Response [ ] No Response

_____

_____

_____

25. How much more would you be willing to pay for the exact features and level of service and support you need?

[ ] Would not pay additional fees
[ ] Uncertain
[ ] Willing to pay 1-5% more
[ ] Willing to pay 6-10% more
[ ] Willing to pay 10% or more

26. **(RESPONDENTS WITH NO SERVICES PROVIDED IN Q.11)**

How likely is it that you will utilize your current service vendors to provide you with the expanded and nontraditional services we've been discussing?

[ ] Very Likely
[ ] Somewhat Likely
[ ] Uncertain
[ ] Somewhat Unlikely } **skip to Q.29)**
[ ] Very Unlikely

27. **(RESPONDENTS WITH SOME/ALL SERVICES PROVIDED IN Q.11)**

How likely is it that you will switch service suppliers over the next 12 months?

[ ] Very Likely
[ ] Somewhat Likely
[ ] Uncertain
[ ] Somewhat Unlikely } **skip to Q.29)**
[ ] Very Unlikely

28. Why?

[ ] Response [ ] No Response

_____

_____

_____

29. How much was paid to external service vendors over the course of 1990 for service and support on <u>all</u> of your establishment's installed equipment base?

[Note ALL exceptions, clarifications] $_____

30. How much do you expect this figure to change for 1991?

[ ] Increase (by what percent? _____%)

[ ] Remain the same **(skip to Q.32)**

[ ] Decrease (by what percent? _____%)

31. Why?

[ ] Response [ ] No Response

_____

_____

_____

32. How much do you anticipate this figure to change in the next 5 years?

[ ] Increase (by what percent? _____%)

[ ] Remain the same

[ ] Decrease (by what percent? _____%)

33. Compared to your Fiscal Year 1990, has the proportion of your total annual operating budget dedicated to service and support changed for 1991?

[ ] Increased (by what percent? _____%)

[ ] Remained the same

[ ] Decreased (by what percent? _____%)

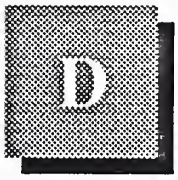
34. To wrap this up, may I ask what you would consider to be the single most important service and support issue for the computer systems end-user?

_____

_____

_____

(THIS COMPLETES THE QUESTIONNAIRE. I WOULD LIKE TO THANK YOU ON BEHALF OF INPUT FOR HELPING US TO COMPLETE THIS STUDY. TO EXPRESS OUR APPRECIATION FOR YOUR TIME AND EFFORTS, WE WILL BE SENDING YOU A "THANK YOU" PACKAGE CONTAINING A SUMMARY OF THE RESULTS FROM OUR SURVEY. TO MAKE SURE YOU RECEIVE OUR COMPLIMENTARY REPORT SUMMARY, LET ME CHECK THE SPELLING OF YOUR NAME AND ADDRESS INFORMATION. **CONFIRM AND RECORD ON COVER SHEET**)



Vendor Questionnaire

INTRODUCTION/SCREENER; **VENDOR** QUESTIONNAIRE

(ASK FOR SPECIFIC CONTACT IF AVAILABLE FROM SAMPLE. IF NONE AVAILABLE, ASK TO BE CONNECTED WITH THE PERSON RESPONSIBLE FOR BUSINESS DEVELOPMENT AND MARKETING OF MAINTENANCE, REPAIR, AND SUPPORT SERVICES FOR THE COMPANY.)

(INTRODUCTION TO OPERATOR); (IF NECESSARY):

Good morning/afternoon/evening. I'm Mr/Ms _____ calling long distance from INPUT in _____, and we are conducting a study about new trends in services delivery in the computer and electronic systems and equipment marketplace.

(WHEN MANAGER COMES TO PHONE: INTRODUCTION TO MANAGER / CUSTOMER SERVICE MANAGER)

Good morning/afternoon/evening. I'm Mr/Ms _____ calling from INPUT in _____. We are conducting a study to assess new trends in service delivery with regard to computer and information-processing equipment and systems and their end-users.

A. Just to check, do you have responsibility for business development and marketing of your company's service portfolio and organziation?

[ ] Yes (GO TO INTRODUCTION)
[ ] No

B. May I please speak with that person? (OBTAIN NAME/TITLE/DEPARTMENT AND ASK TO BE CONNECTED, THANK INITIAL CONTACT, AND TERMINATE.)

(NOTE: BEFORE CONTINUING TO MAIN QUESTIONNAIRE, RESPONDENT MUST ANSWER "YES" TO QUESTION A.)

(INTRODUCTION)

As part of INPUT'S continuing research programs, we are conducting a survey to investigate current and developing trends in service products and delivery innovations. Your response would lead to more-effective support options in the future. We would be happy to supply you with a summary of our findings from the subsequent report.

Would you have a few minutes at this time, or would you prefer I call back at a more convenient time?

[ ] IF AVAILABLE, CONTINUE WITH MAIN QUESTIONNAIRE, Q.6

[ ] IF NOT AVAILABLE, ARRANGE FOR CALLBACK

Callback Date: _____

Specific Time: _____AM/_____PM

MAIN VENDOR QUESTIONNAIRE

I. BACKGROUND (to be verified against sample information during the introduction process)

A. Sample Segment:

[ ] TPM/ISO/IMO
[ ] OEM Service Organization
[ ] VAR
[ ] Distributor

B. Title of Respondent: (DO NOT READ LIST)

[ ] Director Customer/Field Service
[ ] Director Marketing (Service)
[ ] Director Business Development
[ ] Other: (Specify: _____)

(BEGIN READING QUESTIONS. PLEASE READ VERBATIM)

1. How would you define your company? Would you consider it to be a:

[ ] Independent Service Organization (ISO)
[ ] OEM Service Organization
[ ] VAR (Value-Added Reseller)
[ ] Distributor with a service organization

(IF VOLUNTEERED)

[ ] Other (Specify: _____)

2. Approximately how many field engineers and/or technicians do you have operating in your service organization in total? (within continental U.S.)?

   Number of Field Engineers in U.S.: _____

3. In total, how many offices does your firm operate in the U.S.?

   Total Number of Offices in U.S.: _____

II. ONE-STOP CUSTOMER/FIELD SERVICE AND SUPPORT

4. Some industry sources suggest a swing by the end-user toward contracting with a single company to meet all service requirements—tying systems software support, applications support, and related issues with the traditional aspects of multivendor hardware service. CONSIDERING YOUR CUSTOMER BASE, how strongly do you agree or disagree with this statement? Again use the scale where 1 indicates that you DO NOT AGREE AT ALL with the statement and a 5 indicates that you AGREE STRONGLY.

Do Not Agree	1
	2
	3
	4
Agree Strongly	5

5. Does your service organization offer this type of "single point of contact" service?

   [ ] Yes**(skip to Q.7)** [ ] No

6. Do you plan on developing this type of service in the next 12 months?

   [ ] Yes [ ] No **(skip to Q.9)**

7. What technology or operational changes, if any, have been implemented to deal with the increased service demand involved with the roll-out and delivery of these new services?

   [ ] Response [ ] No Response **(skip to Q.9)**

   _____

   _____

   _____

8. Can you estimate the costs involved with these changes?

   Costs of Roll-Out $_____

9. In delivering service to the end-user, have you subcontracted certain service activities to other service vendors?

[ ] Have subcontracted
[ ] Have not subcontracted **(skip to Q.14)**

10. Which types of services you are most likely to contract out?

[ ] Response [ ] No Response

_____

_____

_____

11. Is this subcontracting activity transparent to the end-user?

[ ] Yes, subcontract is unknown to end-user
[ ] No, the end-user is aware of subcontract

12. Has this subcontracting of service developed into any formal alliances or agreements with other service organizations?

[ ] Formal alliances have been made
[ ] No formal alliances have been made **(SKIP TO Q.14)**

13. Can you identify the name or type of company you have allied with? What are the general characteristics of the agreement?

Name/Type of Company	Agreement Characteristics
1._____	_____
2._____	_____
3._____	_____
4._____	_____

III. EXPANSION/INNOVATION OF SERVICES

14. Which of the following types of information-processing equipment do you presently provide service for? (READ LIST AND RECORD IN COLUMN A.)

Which, if any, of these services were recently added to your service portfolio—that is, within the last 6 months? (RECORD IN COLUMN B.)

15. Over the past 12 months, has your service organization voluntarily stopped supplying service on any of these, or other types, of equipment? (READ BACK THROUGH LIST AS NEEDED TO ASSIST RESPONDENT; RECORD IN COLUMN C.)

16. Of those categories of equipment you do not presently service, do you plan on adding this service in the next 12 months? (RECORD IN COLUMN D.)

TYPE OF EQUIPMENT	A CURRENTLY SERVICES	B RECENTLY ADDED SERVICES	C DROPPED SERVICES	D PLANS TO ADD IN NEXT 12M
DATA PROCESSING:				
- Mainframes	[ ]	[ ]	[ ]	[ ]
- Mini (Midrange) Comp.	[ ]	[ ]	[ ]	[ ]
- Workstations/PCs	[ ]	[ ]	[ ]	[ ]
- CRTs/Data Terminals	[ ]	[ ]	[ ]	[ ]
Terminal Networks	[ ]	[ ]	[ ]	[ ]
LANs	[ ]	[ ]	[ ]	[ ]
Peripherals	[ ]	[ ]	[ ]	[ ]
- Disk Drives	[ ]	[ ]	[ ]	[ ]
OFFICE AUTOMATION:				
- Copiers	[ ]	[ ]	[ ]	[ ]
- FAX machines	[ ]	[ ]	[ ]	[ ]
OTHER:				
_____	[ ]	[ ]	[ ]	[ ]
_____	[ ]	[ ]	[ ]	[ ]
_____	[ ]	[ ]	[ ]	[ ]

17. In general, can you indicate the primary reason(s) your service organization chose to add or drop these equipment categories to your services? (RECORD APPROPRIATE EQUIPMENT TYPE WITH ASSOCIATED RESPONSE.)

RESPONDENTS WHO RECENTLY ADDED SERVICES

[ ] Response [ ] No Response

_____

_____

_____

RESPONDENTS WHO DROPPED SERVICES

[ ] Response [ ] No Response

18. The continuing delivery of systems and products utilizing advanced technologies to the end-user is evident. (e.g., CD ROM, virtual networks, image processing, extensive application of LANs)

Please explain any major effects these new technologies have on the service requirements of your customer base? (PROBE)

[ ] Response [ ] No Response

19. Which of the following service features do you provide to the end-user for those types of equipment you have mentioned. (RECORD BELOW IN COL. A.)

20. For each service feature you do offer, would you classify that feature as part of your "basic" services or as a "premium" feature?

SERVICE FEATURE	DOES PROVIDE TO END-USER	FEATURE PERCEIVED "BASIC"	FEATURE PERCEIVED "PREMIUM"
Parts	1	1	2
Labor	1	1	2
Preventive Maintenance	1	1	2
7-Day/24-Hour Service	1	1	2
4-Hour Response Time	1	1	2
2-Hour Response Time	1	1	2
1-Hour Response Time	1	1	2
Unlimited Service Calls	1	1	2
Uptime Guarantee	1	1	2
Depot Service Availability	1	1	2
On-Site Service Engineer	1	1	2
Telephone Support	1	1	2
Replacement/Loaner Units	1	1	2
Installations/Moves/Adds	1	1	2

21. Does your company specifically target any vertical-market segments when selling and packaging the service products you have mentioned? If so, which?

Vertical Market Served

_____
_____
_____
_____
_____

22. In addition to the service features traditionally offered by a customer service organization, do you provide any of the following services or products to the end-user?

EXPANDED SERVICE PRODUCTS	DOES OFFER	RECENTLY ADDED	PLANS TO ADD
PLANNING/DESIGN SERVICES:			
- Design & Engineering	1	2	3
- Site Planning	1	2	3
- Purchase Consultation	1	2	3
NETWORK SERVICES:			
- Cabling	1	2	3
- Configuration Planning	1	2	3
- Capacity Planning	1	2	3
- Network Maintenance	1	2	3
- Network Management	1	2	3
SOFTWARE AND SERVICES:			
- Applications Training	1	2	3
- Standardized Software Products	1	2	3
- Custom Applications Development	1	2	3
HUMAN RESOURCES:			
- Recruitment/Staffing	1	2	3
- Temporary Personnel	1	2	3
DISASTER RECOVERY SERVICES:	1	2	3
SECURITY SERVICES:			
- Network/System Security:	1	2	3
- Security Planning	1	2	3

23. What percentage of your service revenues would you estimate comes from the basic/traditional services, and what percentage comes from the delivery of expanded or nontraditional services?

Traditional/Basic % _____
Nontraditional/Basic % _____
100%

IV. IMPACT OF NEW TECHNOLOGIES

24. Do you provide or require continuing education for your field engineers in any of the following areas? If so, approximately how much time in days or weeks is dedicated to that topic? **(RECORD TIME IN DAYS!!!!)**

EDUCATIONAL FOCUS/TOPIC	Prov./Req.	Days/Year
Software Maintenance	1	#_____
Maintenance & Repair of New Hardware Technologies	1	#_____
Customer Relations/ Communications Skills	1	#_____
Sales Development (Cross Sales Dev.)	1	#_____
Competitive Intelligence Gathering	1	#_____

25. Do you incorporate any level of field service information system in your Organization?

[ ] Yes **(skip to Q.27)** [ ] No

(NOTE: *field service information system* (FSIS) is defined as: a software application designed to provide service management with a high level of control over the service infrastructure by providing data regarding operations, performance, accounting, inventory movement, service call histories, field personnel activity, etc.)

26. Do you have plans to implement any level of field service information system within the next 12 months?

[ ] Yes [ ] No **(skip to Q.35)**

27. On a scale of 1 to 5, how would you relate the degree of competitive advantage you feel you have received from the implementation of the FSMS in your service operation? 1 indicates that you believe the FSMS provides you with NO COMPETITIVE ADVANTAGE AT ALL, and 5 indicates that the implemenation of the FSMS provides you with SIGNIFICANT COMPETITIVE ADVANTAGE

No Competitive Advantage 1
2
3
4
Significant Comp. Advan. 5

28. Was this field service information system developed as a custom application or was it purchased as a standardized applications package?

[ ] Custom FSMS
[ ] Standardized FSMS Package

29. Which of the following functions does your present/planned field service information system support?

[ ] Call Handling and Dispatch
[ ] Inventory Control
[ ] Customer Information File/Database
[ ] Service Billing
[ ] Remote Hardware Diagnostics
[ ] Remote Software Diagnostics/Repair

(DOES THIS SYSTEM SUPPORT ANY OTHER FUNCTIONS?)

[ ] Other: (Specify:_____)

30. Were these functions implemented at the same time? If not, which function did you choose to implement first?

Function Implemented First: _____

31. Which, of the system functions you mentioned, do you feel provides the greatest benefit TO THE END-USER?

[ ] Call Handling and Dispatch
[ ] Inventory Control
[ ] Customer Information File/Data Base
[ ] Service Billing
[ ] Other: (Specify:_____)

32. Approximately, what has been your total investment in implementing your FSIS to date?

Total FSIS Investment $_____

33. On a scale from 1 to 5, please rate the amount of hard cost savings each FSMS function has provided to your organization. 1 indicates NO HARD COST SAVINGS, and 5 indicates SIGNIFICANT HARD COST SAVINGS. You may use any number from 1 to 5.

FROM Q.29

[ ] Call Handling & Dispatch

No Hard Savings 1
2
3
4
Significant Savings 5

[ ] Inventory Control

No Hard Savings 1
2
3
4
Significant Savings 5

[ ] Customer Information File /Database

No Hard Savings 1
2
3
4
Significant Savings 5

[ ] Service Billing

No Hard Savings 1
2
3
4
Significant Savings 5

[ ] Remote Hardware Diagnostics

No Hard Savings 1
2
3
4
Significant Savings 5

[ ] Remote Software Diagnostics/Repair

No Hard Savings 1
2
3
4
Significant Savings 5

34. Which of these functions provides your service organization with the greatest soft benefits—that is, contributes the most to refining or improving your service delivery and quality? 1 indicates the function offers NO SOFT BENEFITS, and 5 indicates the function CONTRIBUTES SIGNIFICANT SOFT BENEFITS.

FROM Q.29		
[ ] Call Handling & Dispatch	No Soft Benefits	1
		2
		3
		4
	Significant Soft Benefits	5
[ ] Inventory Control	No Soft Benefits	1
		2
		3
		4
	Significant Soft Benefits	5
[ ] Customer Information File	No Soft Benefits	1
		2
		3
		4
	Significant Soft Benefits	5
[ ] Service Billing	No Soft Benefits	1
		2
		3
		4
	Significant Soft Benefits	5
[ ] Remote Hardware Diagnostics	No Soft Benefits	1
		2
		3
		4
	Significant Soft Benefits	5
[ ] Remote Software Diagnostics/Repair	No Soft Benefits	1
		2
		3
		4
	Significant Soft Benefits	5

V. PERCEPTIONS ON CURRENT CUSTOMER/FIELD SERVICES MARKET

35. Considering the overall services market, how strongly would you agree or disagree with the following statements, where a 1 indicates that you DO NOT AGREE AT ALL and a 5 indicates that you AGREE STRONGLY. You may use any number from 1 to 5.

A. There will be significant growth in the traditional services (10%+ annually).

Do Not Agree	1
	2
	3
	4
Agree Strongly	5

B. Significant growth in traditional customer service markets will be seen through innovative marketing and/or the restructuring of service delivery mechanisms.

Do Not Agree	1
	2
	3
	4
Agree Strongly	5

C. Significant growth will develop through the delivery of allied, nontraditional services by customer service organizations.

Do Not Agree	1
	2
	3
	4
Agree Strongly	5

D. Overall market growth cannot be assessed in the aggregate. Technology and vigorous end-user demands have brought the competition to the segment and niche level. Significant growth will be seen in specific areas, not in the overall market.

Do Not Agree	1
	2
	3
	4
Agree Strongly	5

VI. ADDITIONAL CLASSIFICATION

(FINALLY, FOR CLASSIFICATION PURPOSES:)

36. Over the past 12 months, do you estimate that your company's service revenues have:

[ ] Increased Significantly (>10%)
[ ] Increased, but at a rate less than 10%
[ ] Remained about the same
[ ] Decreased

37. To wrap this up, may I ask what you would consider to be the single most important issue for the service vendor in the current marketplace?

_____

_____

_____

(THIS COMPLETES THE QUESTIONNAIRE. I WOULD LIKE TO THANK YOU ON BEHALF OF INPUT FOR HELPING US TO COMPLETE THIS STUDY. TO EXPRESS OUR APPRECIATION FOR YOUR TIME AND EFFORTS, WE WILL BE SENDING YOU A "THANK YOU" PACKAGE CONTAINING A SUMMARY OF THE RESULTS FROM OUR SURVEY. TO MAKE SURE YOU RECEIVE OUR COMPLIMENTARY REPORT SUMMARY, LET ME CHECK THE SPELLING OF YOUR NAME AND THE ADDRESS INFORMATION. CONFIRM AND RECORD ON COVER SHEET.)